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INTEGRATED ENVIRONMENTAL MONITORING PLAN

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

OCTOBER 2000

U.S. DEPARTMENT OF ENERGY

2505-WP-0022
REV. 2
DRAFT FINAL

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LIST OF ACRONYMS

AMS	air monitoring station
ANSI	American National Standards Institute
ARAR	applicable or relevant and appropriate requirement
ARPA	Archaeological Resources Protection Act
ARWWP	Aquifer Restoration and Wastewater Project
ASL	analytical support level
AWWT	advanced wastewater treatment facility
BAT	Best Available Technology
BTVs	benchmark toxicity values
CAP88-PC	Clean Air Act Assessment Package 1988
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPRD	continuous passive radon detector
CWA	Clean Water Act
D&D	decontamination and dismantling
DCF	dose conversion factors
DOE	U.S. Department of Energy
EMP	Fernald Site Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Agreement
FRL	final remediation level
GPMPP	Groundwater Protection Management Program Plan
HAMDC	Highest Allowable Minimum Detection Concentration
IEMP	Integrated Environmental Monitoring Plan
MCL	maximum contaminant level
MDC	minimum detectable concentration
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards Hazardous Air Pollutant
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRMP	National Resource Monitoring Plan
NRRP	Natural Resource Restoration Plan
O&M	operations and maintenance
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency

LIST OF ACRONYMS
(Continued)

OPI	Oversight and Project Integration
ORC	Ohio Revised Code
OSDF	on-site disposal facility
RCRA	Resource Conservation and Recovery Act
SCQ	FEMP Sitewide CERCLA Quality Assurance Project Plan
SWIFT	Sandia Waste Isolation Flow and Transport
SWPPP	Storm Water Pollution Prevention Plan
TBC	to be considered
TLD	thermoluminescent dosimeter
U.S.C.	United States Code
Ci/g	Curies per gram
µg/g	micrograms per gram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mrem	millirem
pCi/g	picoCuries per gram
pCi/L	picoCuries per liter
pCi/m^2/sec	picoCuries per square meter per second

Section 1.0

1.0 INTRODUCTION

1.1 BACKGROUND

The U.S. Department of Energy's (DOE's) Fernald Environmental Management Project (FEMP) has completed its sitewide remedial investigation/feasibility study obligations, and final records of decision for all five FEMP operable units are now in place.[1] With the conclusion of the FEMP's remedial investigation/feasibility study and remedy selection process, focus is now being directed to the safe and efficient implementation of site remediation activities and facility decontamination and dismantling operations. In recognition of this focus on remedy implementation, DOE has developed an integrated environmental monitoring strategy that is tailored to the remediation activities planned for the FEMP. The monitoring strategy is documented in this Integrated Environmental Monitoring Plan (IEMP).

The IEMP directs environmental monitoring program elements toward sitewide remediation activities and incorporates any new regulatory requirements for sitewide monitoring, reporting, and remedy performance tracking activated by the formal applicable or relevant and appropriate requirements (ARARs) identified in the FEMP's remedy selection documents. The IEMP also serves as the reporting link for project-specific emission control monitoring activities that will accompany remediation and decontamination and demolition projects during the life of the FEMP remediation program.

The basis for the current understanding of environmental conditions at the FEMP is the extensive site environmental data that have been collected. The data were collected through the 10-year remedial investigation process required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended; as well as the four years of subsequent routine environmental monitoring data collected through the IEMP. The remedial investigation data culminated in the selection of a final remedy for the FEMP's environmental media, with the issuance of the Final Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b) in January of 1996. Operable Unit 5 includes all environmental media, contaminant transport pathways, and environmental receptors (soil, groundwater, surface water, sediment, air, and biota) at and around the FEMP that have been affected by past uranium production operations. The remedy for Operable Unit 5 defines final sitewide cleanup levels and

[1]Feasibility Study testing for Operable Unit 4 (Silos 1 and 2) has been reinitiated. An amendment to the Operable Unit 4 Record of Decision defining the selected remedial treatment process for the contents of Silos 1 and 2 is expected in 2001.

establishes the general areal extent of on- and off-property actions necessary to mitigate environmental impacts caused by site production activities. A clearer picture of the scope and intensity of the sitewide environmental monitoring activities necessary to determine the impacts of past production and current remediation activities continues to emerge as data are collected and interpreted.

The IEMP is a formal remedial design deliverable required to fulfill Task 9 of the Remedial Design Work Plan for Remedial Actions at Operable Unit 5 (DOE 1996c). This revision to the IEMP (Revision 2) provides an update to the original IEMP (approved in August of 1997) as required by the Remedial Design Work Plan and DOE Order 5400.1.

1.2 PROGRAM OBJECTIVES AND SCOPE

As remediation projects move beyond the design phase into implementation or operation, the need for accurate, accessible, and manageable environmental monitoring information will increase. The IEMP has been formulated to meet this need and will serve several comprehensive functions for the site over the life of the FEMP's accelerated remediation program:

- Maintain the FEMP's commitment to a remediation-focused environmental surveillance monitoring program that is consistent with DOE Orders 5400.1 and 5400.5 and continues to address stakeholder concerns. Both orders are listed as to be considered-based criteria in all FEMP records of decision, and therefore are key drivers for the scope of the monitoring program.

- Fulfill additional sitewide monitoring and reporting requirements activated by the CERCLA ARARs for each FEMP record of decision

- Provide the mechanism for assessing the performance of the Great Miami Aquifer groundwater remedy, including determining when restoration activities are complete

- Provide a reporting mechanism for many environmental regulatory compliance monitoring activities (i.e., on-site disposal facility groundwater monitoring; Federal Facility Compliance Agreement and elements of the National Pollutant Discharge Elimination System discharge reporting; and the air-pathway-specific dose estimates required under National Emissions Standards for Hazardous Air Pollutants [NESHAP] Subpart H) with the environmental reporting for DOE Order 5400.1

- Provide a reporting interface for the various project-specific emission control monitoring activities that, because of ARAR requirements, will be implemented at project locations under approved project-specific remedial design plans.

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Under the IEMP, data showing the baseline environmental conditions at the FEMP are collected and maintained, and contaminant releases attributable to remedial activities at the FEMP are evaluated and kept within established thresholds. DOE fulfills its obligation to document most environmental monitoring information under the umbrella of the IEMP reports. The monitoring program is designed to appraise and report upon the effectiveness of the administrative and engineering emission controls accompanying the individual remediation projects.

Several remediation-based environmental activities fall outside the scope of the IEMP. These activities include:

- Some project-specific emission-control monitoring activities, which because of ARARs, are being implemented under project-specific design plans outside of the IEMP. These projects and accompanying remedial design plans are identified and their reporting interfaces with the IEMP are described in subsequent sections of this document.

- The soil remediation pre-certification and certification sampling program which will be conducted as part of the work scope of the Soil and Disposal Facility Project

- The ambient air sampling and direct radiation measurements conducted for worker health and safety purposes as part of the FEMP's occupational monitoring program

- The FEMP's spill and chemical release reporting required under Superfund Amendment and Reauthorization Act Title III.

Each of these efforts will continue to be conducted outside the formal scope of the IEMP, although the results of the efforts will be factored, as necessary, into the sitewide interpretations provided in IEMP reports.

In addition to the environmental activities specifically excluded from the scope of the IEMP, boundary conditions throughout the IEMP further define the IEMP scope. These boundary conditions are:

- The administrative boundary lies between DOE remedial actions for groundwater south of the FEMP and those potential remedial actions associated with the Paddys Run Road Site plume. This boundary is shown in the Feasibility Study Report for Operable Unit 5 (DOE 1995b) and Proposed Plan for Operable Unit 5 (DOE 1995c).

- The programmatic boundary refers to the differentiation between the scope and responsibility associated with the design, implementation, and documentation of monitoring activities. Monitoring activities are designated as project-specific (associated with emission controls at the project) or IEMP (associated with monitoring the collective impact on a particular environmental medium resulting from all remediation activities). The designation is based on an evaluation of the pertinent regulatory drivers and DOE policies that have monitoring implications.

- The geographic boundary refers to the physical boundary of a project or activity.

Sitewide monitoring measures the collective environmental impacts resulting from all remediation activities. This term is used to refer to IEMP monitoring programs.

1.3 RELATIONSHIP TO PROJECT-SPECIFIC REMEDIAL PROGRAMS

To define the interface between the IEMP and the individual remediation projects, the monitoring-related ARARs in the FEMP's records of decision were evaluated. During the ARARs analysis, monitoring requirements were evaluated to determine if they had sitewide implications, and therefore, fell under the scope of the IEMP, or pertained to project-specific monitoring as part of the emission controls implemented by individual remediation projects. The results of these evaluations are presented for each environmental medium in Sections 3.0 through 7.0.

The programmatic boundary established through the IEMP designates which monitoring activities will be the responsibilities of the remediation projects. Establishing this boundary ensures that:

- The roles and responsibilities for designing, implementing, and reporting upon monitoring activities are explicitly understood by the FEMP project organizations, their regulatory counterparts, and FEMP stakeholders

- That all regulatory obligations for conducting and documenting the results of monitoring activities are identified and met

- That monitoring and reporting activities are integrated to promote efficiency of execution and support consistency in technical approach and data interpretations.

To fully delineate this programmatic boundary, it is necessary to clearly define the scope of monitoring activities that will be executed by individual remediation projects and their relationship to the IEMP. Project-specific monitoring activities are divided into compliance monitoring and process control monitoring categories.

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Project-specific compliance monitoring will be implemented by remediation projects to meet the requirements of monitoring related ARARs designated as project-specific through the ARARs analysis presented in each media-specific section of the IEMP. The results of the ARARs analysis provides the basis for determining when project-specific compliance monitoring programs will be developed. If there is no project-specific responsibility for monitoring identified through the ARARs analysis, then no project-specific compliance-monitoring program will be developed. For those ARARs designated as project-specific, the affected remediation project is responsible for designing, implementing, and documenting the monitoring program in compliance with the requirement and for identifying any programmatic interface with the IEMP. This responsibility includes meeting all reporting obligations for demonstrating compliance with the given requirement.

Project-specific process control monitoring is designed and implemented by the individual remediation project to provide timely feedback on the performance of a remediation treatment process or operation relative to a design specification. This information is used to adjust the process or operation to ensure that conditions remain within specified operating parameters. In general, process control schemes rely on real-time or near real-time measurements or quick turnaround analytical methods that provide prompt feedback on system performance. Due to the need for a quick response, process control measurements primarily occur within a treatment process or operation. However, under certain circumstances, monitoring of environmental media at or near a project boundary may be appropriate within the process control scheme of a specific project operation. The following criteria provide the basis for determining when project-specific process control monitoring within environmental media will be considered by the affected projects.

- Projects processing and/or treating waste materials (such as process residues) which pose a significant risk to human health and/or the environment. These projects are associated with remediation activities for Operable Units 1 and 4.
- When, due to the location of the remediation activity on the FEMP property, it is likely that emissions from the project will not be assessed through the sitewide monitoring programs defined under the IEMP.

While the criteria listed above provide a basis for determining when additional project-specific environmental monitoring (beyond that required to meet ARAR obligations) may be implemented, it is not intended to limit the range or scope of potential monitoring activities that may be implemented to successfully complete site remediation. Additional process control monitoring may be proposed in response to changes in the remedial design or discovery of unanticipated field conditions.

The IEMP will provide a reporting link for project-specific compliance and process control results, as necessary, to fulfill its responsibility for providing a comprehensive evaluation of sitewide environmental conditions. Each remediation project will continue to be responsible for the design and execution of its own monitoring activities required to demonstrate compliance with its respective project-specific monitoring ARARs and to obtain the necessary immediate feedback required for effective process control. The information collected through both project-specific and IEMP monitoring programs will be used to support a remedial action decision-making process during active site remediation. The role of each monitoring program and the range of decisions encompassed within this process are discussed in detail in Section 1.5.

1.4 PLAN ORGANIZATION

The IEMP is comprised of seven sections and four appendices. The remaining sections and their contents are as follows:

Section 2.0	Summary of the FEMP Remedial Strategy: provides a description of the individual remediation projects for each of the FEMP's five operable units, a status summary of the project-specific monitoring that is planned for each project, and a two-year (2001 and 2002) forecast of the remediation activities planned for each major project
Section 3.0	Groundwater Monitoring Program: provides a description of the monitoring activities necessary to track the progress of the restoration of the Great Miami Aquifer and discusses the groundwater monitoring activities necessary to maintain compliance with Resource Conservation and Recovery Act requirements at the FEMP property boundary; and the groundwater monitoring program for the on-site disposal facility
Section 4.0	Surface Water and Treated Effluent Monitoring Program: provides a description of the routine sitewide surface water monitoring to be performed during active remediation of the FEMP and to maintain compliance with treated-effluent surface water discharge requirements
Section 5.0	Sediment Monitoring Program: provides a description of the routine sitewide sediment monitoring activities to independently verify the overall effectiveness of the sediment controls accompanying the FEMP's remedial construction and excavation activities

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Section 6.0	Air Monitoring Program: provides a description of the sitewide air monitoring to be conducted during active remediation of the FEMP and includes a description of the plan for particulate, radon, and direct radiation measurements and the continuation of the FEMP's Meteorological Monitoring Program
Section 7.0	Biota Monitoring Program: identifies the scope of monitoring activities that will be maintained during remediation to verify the continued protection of local produce grown in proximity to the FEMP
Section 8.0	Program Summary and Reporting: summarizes the program design, scope of each media monitoring program, and provides a detailed accounting of the reporting elements included within the IEMP reporting framework
Appendix A	Detailed Explanation of Constituent Selection for the Groundwater Monitoring Program
Appendix B	Surface Water FRL and BTV Exceedances
Appendix C	Dose Assessment: summarizes the IEMP's responsibility for preparing the FEMP's annual dose assessment related to remediation activities to comply with NESHAP Subpart H requirements and the intention of DOE Order 5400.5
Appendix D	Natural Resource Monitoring Plan (NRMP): provides the regulatory requirements and strategy for the monitoring of ecological impacts to wetlands, threatened and endangered species, and terrestrial and aquatic habitats. The NRMP also outlines additional provisions for reporting these monitoring results to FEMP Natural Resource Trustees. Additionally, the NRMP identifies the relationship of this monitoring effort with other relevant documents, such as the Sloan's Crayfish Management Plan.

As this format indicates, the IEMP is organized according to the principal environmental media and contaminant migration pathways routinely examined under the program. For each of the media comprising the program, evaluations of the regulatory drivers and pertinent DOE policies that govern environmental monitoring for that media were conducted. Findings were made regarding those drivers that have sitewide implications and those that are project-specific in scope (and therefore fall outside the domain of the IEMP). This evaluation was used to define, for each media, the ARAR-driven administrative boundaries that separate the project-specific emission control monitoring activities from those sitewide environmental monitoring activities that are the responsibility of the IEMP. The results of these responsibility- and boundary-definition evaluations are presented in detail for each respective media in Sections 3.0 through 7.0.

Following the review of the regulatory drivers, the scope of the monitoring activities conducted under the former Environmental Monitoring program (EMP) was evaluated against the remediation work scope contemplated under the FEMP's sitewide accelerated remediation schedule. Any alterations to existing scope that were deemed appropriate were made, based on:

- The knowledge of environmental conditions gained through the remedial investigation/feasibility study process
- The many years of sitewide monitoring conducted under the former EMP during and after full-scale uranium production operations
- The expectations of FEMP stakeholders for continued surveillance monitoring.

The existing scope of the environmental monitoring program was also evaluated to determine whether any existing effluent monitoring elements are project specific in intent and are, therefore, best accommodated by the individual remediation projects. The results of these evaluations, coupled with the evaluation of the regulatory drivers and pertinent DOE policies, were used to define the initial scope of the IEMP for each of the individual media. Finally, a media-specific plan was prepared for each media to define detailed program implementation requirements. The details and results of this process are individually presented for each media in the media-specific sections of the plan (Sections 3.0 through 7.0).

1.5 ROLE OF THE IEMP IN REMEDIAL ACTION DECISION MAKING

As indicated in Section 1.2, one of the primary responsibilities of the IEMP is to document that the FEMP's cumulative environmental emissions resulting from the implementation of multiple, concurrent, remedial-action projects at the site do not exceed the FEMP's regulatory-based limits or result in unacceptable off-site conditions. Fundamental to this role is the recognition that each individual remedial action project at the FEMP is expected to be implemented and operated in full compliance with its project-specific emission control requirements for the respective environmental pathways of concern. It is thus the responsibility of the individual remedial design documents (required by the CERCLA Remedial Design Work Plans for each of the FEMP's five operable units) to convey the project-specific measures for satisfying worker's health and safety, process-control, and environmental-protection requirements accompanying each remedial action project. Under this fundamental expectation, the IEMP can then serve to provide independent oversight assurance that there are no undesirable compounding environmental effects resulting from the concurrent implementation and operation of otherwise fully compliant individual projects.

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In light of this oversight responsibility, the data generated through the IEMP are expected to support a number of management decisions regarding the progressive implementation strategy, sequence, and overall management control of the FEMP's individual remedial action projects. This subsection highlights: 1) the key management decisions that will be supported by the IEMP; 2) the organizational responsibilities for making the decisions; 3) the framework and criteria needed to facilitate the decisions; and 4) the communication process for internally conveying the results of the decisions to the respective project organizations and externally to the FEMP's stakeholders. Each of the individual environmental media sections of this plan (Sections 3.0 through 7.0) will provide detailed discussions of the specific IEMP data-use and decision-making criteria that are relevant to that particular media.

1.5.1 What are the Management Decisions that the IEMP Will Support?

In its role of compiling the information necessary to assess cumulative multiple-project sitewide impacts, the IEMP will be expected to support the following key management decisions:

- From a sitewide perspective, is the FEMP maintaining compliance with its various regulatory requirements for emission control and environmental monitoring?
- Are there any trends in the sitewide environmental monitoring data that indicate the potential for an unacceptable future condition?
- In the event of a regulatory non-compliance situation or potentially unacceptable cumulative trend, what activities or projects are the principal contributors to the situation?
- What specific response actions must be taken to address the situation, and which projects are affected?
- What communications are necessary with regulatory agencies or other concerned stakeholders as a result of the situation and/or decisions made?

The response action decisions necessary to address potentially undesirable cumulative effects could involve:

- Upgrading project-specific emissions controls (beyond those that are regulatory based) for one or more projects to reduce cumulative emissions further
- Slowing the pace of activities within one or more remedial projects for a specified period of time

- Altering the number or variety of active projects underway at a particular time
- Continued monitoring of cumulative data trends.

As discussed in the next subsection, FEMP decision-makers will be conducting ongoing evaluations of the data generated by both the projects and the IEMP to ensure satisfactory operating conditions are maintained during remedy implementation.

1.5.2 Who is Responsible for Making the Decisions?

The FEMP's sitewide environmental data will be used by FEMP management personnel to closely monitor the acceptability of the various remedial projects underway at any particular time. Thus, the bulk of the day-to-day planning and routine operating decisions will be internal to the FEMP, with process adjustments implemented as necessary on a situation-specific, as-needed basis.

It is anticipated that in the vast majority of cases, the data evaluation will conclude that all regulatory requirements are being met and that no unacceptable cumulative trends in the monitoring data are present. The FEMP's evaluation and conclusions will be documented for regulatory agency concurrence through the normal reporting mechanisms described in this plan.

The FEMP will notify the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) immediately (prior to taking an action internally) for three important, albeit unlikely, situations:

- The FEMP's evaluation indicates that a regulatory schedule milestone is in jeopardy of attainment because of the mitigative actions necessary to address an adverse cumulative situation
- For the air pathway, the FEMP's data evaluation indicates that an actual *current* condition has resulted in an exceedance of a NESHAP regulatory compliance limit (as opposed to an undesirable data trend indicating the potential for an unacceptable hypothetical *future* condition)
- For the air pathway, a projected exceedance of a NESHAP regulatory compliance level is believed to be imminent.

For these three special cases, the FEMP will: 1) identify the root cause of the unacceptable situation; 2) determine the options for addressing the problem; and 3) meet with EPA and OEPA to arrive at a

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mutually acceptable decision concerning the follow-up actions to be taken. For all remaining situations (i.e., those involving the FEMP's responses to undesirable data trends for any of the environmental media), the FEMP will identify and implement appropriate actions internally and will document the decisions and resultant response actions in quarterly summaries and again in IEMP annual integrated site environmental reports (Section 1.5.4).

From an organizational perspective, the cumulative data evaluation and resultant response action decisions will be facilitated by FEMP oversight organizations that operate independently from the remedial projects. The Environmental Compliance Department is responsible for the ongoing review of project-specific and environmental monitoring data and the identification of any related environmental compliance issues. Along with its responsibility for evaluating IEMP data, one of the key roles of this organization is to independently assess the regulatory compliance status of the FEMP as a whole.

If the potential for an unacceptable future situation is identified, then the Site Closure Division will facilitate the process of identifying alternatives for addressing the problem, which could include the temporary shutdown of projects. The Site Closure Division will also work closely with DOE to finalize the decisions, assess their implications, and communicate the results of the evaluations as necessary to the FEMP's stakeholders and to EPA and OEPA.

1.5.3 What are the General Criteria for the Decisions?

The IEMP establishes, on a media-specific basis, the types of data and threshold response-action criteria required to support the management decisions described above. Each set of media-specific criteria are handled uniquely because of the varying media-specific locations where the regulatory criteria are applied. For example, the FEMP's most restrictive air-monitoring criterion (the 10 millirem NESHAP requirements discussed in Section 6.0) is applied at locations at the site's fenceline, near where actual receptors are located. Other media-specific criteria, such as the FEMP's sediment-control performance criteria, apply at the geographic boundaries of the individual projects themselves.

The media-specific sections of this plan review which monitoring requirements are to be met at the project boundaries (and thus fall under the domain of the individual projects) and which requirements fall outside the project boundaries and, because of their cumulative nature, fall under the domain of the IEMP. This responsibility distinction is facilitated by an in-depth ARAR review for each environmental media to identify applicable compliance locations and the resultant responsibilities for meeting them. Additionally, the media-specific sections define the criteria to be used to identify trends in the data that could indicate an imminent, unacceptable situation. Each of the media-specific sections specifies the frequency of the data evaluations to satisfy the FEMP's overall remedial planning and decision-making requirements. DOE will evaluate the FEMP's remediation data accordingly, and will report the results according to the approach summarized below.

1.5.4 How Will IEMP Decisions Be Communicated?

Each media section of this IEMP (Sections 3.0 through 7.0) present media-specific reporting components and Section 8.0 summarizes the reporting strategy for the IEMP. The data will be made available to the regulatory agencies on an ongoing basis through the IEMP Data Information Site. Both IEMP quarterly summaries and annual integrated site environmental reports will be issued as part of the IEMP program. The reports will provide a reporting mechanism for both IEMP data and the project-specific environmental data gathered to meet project-specific regulatory compliance requirements pertinent to sitewide interpretation.

As indicated above, the majority of the management decisions made from IEMP data evaluations will be internally executed by the FEMP, as part of the FEMP's internal remedial planning and operations control practices. These internal decisions fall into two categories:

- Routine "process-adjustment" decisions, which will be made by the FEMP's lead project organizations to react and respond to project-specific operating conditions and process-control objectives
- Major "project-control" decisions, which are the responsibility of the FEMP's Site Closure Division (in collaboration with the affected project organizations) to respond to a pending adverse cumulative situation that, for one reason or another, is developing.

The routine process-adjustment decisions will not necessarily be reported as part of the IEMP quarterly or annual reporting cycles. These types of routine decisions will be maintained as part of the project organizations' daily operations logs and are considered to be a normal course of day-to-day practice to achieve project-specific operating objectives. The major project-control decisions that are the ultimate responsibility of the Site Closure Division will be summarized in IEMP quarterly summaries and in annual integrated site environmental reports. The decision-reporting format will include: 1) a description of the pending adverse conditions; 2) the actions taken to respond to the situation; and 3) the mitigative

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results obtained. All such internal decisions will be made consistent with the FEMP's enforceable work plans and ARAR compliance requirements.

Three special circumstances were identified in Section 1.5.2 that require EPA and OEPA input before response actions are taken by FEMP management. For these three circumstances, EPA and OEPA concurrence will be sought before the actions are taken. Once a mutually agreeable decision is reached, the actions will be implemented. The decision process, actions taken, and results obtained will be summarized in the next available IEMP quarterly summary and tallied in annual integrated site environmental reports.

The IEMP quarterly summaries and annual integrated site environmental reports will be furnished to EPA and OEPA in accordance with the provisions summarized in Section 8.0. The IEMP annual integrated site environmental reports will also be available for inspection by the FEMP's stakeholders at the Public Environmental Information Center.

If it becomes necessary to adjust the acceptable mix of projects underway at a particular time or curtail a planned activity in response to a pending unacceptable cumulative situation, then the Site Closure Division will prioritize project activities and suspend non-priority activities as necessary to avoid a noncompliance. The Site Closure Division's decision will be communicated to all affected parties, including EPA and OEPA.

1.6 PROGRAM MODIFICATIONS AND REVISIONS

The IEMP will remain in place throughout the duration of the FEMP's remediation activities. Accordingly, the IEMP will function as a "living document" with periodic revisions as necessary to accommodate the initiation of new projects and the completion of others. As part of this living document concept, the IEMP, Revision 2, primarily focuses on the remediation activities forecasted for 2001 and 2002. The IEMP will be reviewed annually and revised every two years. Yearly reviews will focus on appropriateness of IEMP scope. The two-year revision cycle will provide for any change in program emphasis or allow for the scale back of monitoring activities deemed no longer appropriate based on project needs, accumulated results, or stakeholder concerns. If necessary, immediate, specific modifications to the IEMP will be made as data are reviewed. The two-year revision cycle for the IEMP will also fulfill the formal commitment for revision of the FEMP's sitewide environmental monitoring program at least every three years as intended by DOE Order 5400.1.

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2.0 SUMMARY OF FEMP REMEDIAL STRATEGY

This section presents a summary of the Fernald Environmental Management Project (FEMP) remedial strategy, including descriptions of the FEMP's five operable units, the remediation projects, and associated large-scale remediation activities; and a two-year (2001 and 2002) forecast of the remediation activities planned for each major project.

2.1 FEMP REMEDIATION STRATEGY

The FEMP's remedial strategy reflects the culmination of nearly 10 years of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities at the site. This includes extensive site characterization activities to determine the nature and extent of contamination, baseline risk assessments, and detailed evaluation and screening of remedial alternatives leading to a final remedy selection as documented in the record of decision for each operable unit. As a management approach to streamlining the remedial investigation/feasibility study decision-making process under CERCLA and expediting implementation of cleanup activities, the site was divided into five operable units. The definitions of the operable units were established considering factors such as geographic location, similarity in waste forms, and the availability of data on discrete waste units or areas.

The FEMP is pursuing an integrated remediation strategy focusing on accelerated remedial design and action. At the heart of this strategy is integrated project planning that consolidates cleanup activities and schedules across the projects to accelerate remediation. Successful implementation of accelerated remediation is dependent upon the close coordination and sequencing of remediation activities, such as on-site disposal facility preparation, facilities decontamination and dismantlement, and final soil and groundwater remediation, among all project organizations throughout the remedial design/remedial action process. The FEMP's accelerated remediation strategy is reflected in the site master schedule, which is summarized in Figure 2-1. Section 2.2 describes activities that are underway or completed.

While the operable unit management approach was successful for completing the remedial investigation/feasibility study process, it does not represent the most effective organization of site responsibility to complete remedial design/remedial action. In order to align sitewide responsibilities and regulatory obligations across the five operable units to most efficiently complete remedial design/remedial action, the FEMP established fully integrated project organizations in 1997. The intent of this projectized approach is to integrate activities among the operable units to ensure that the final

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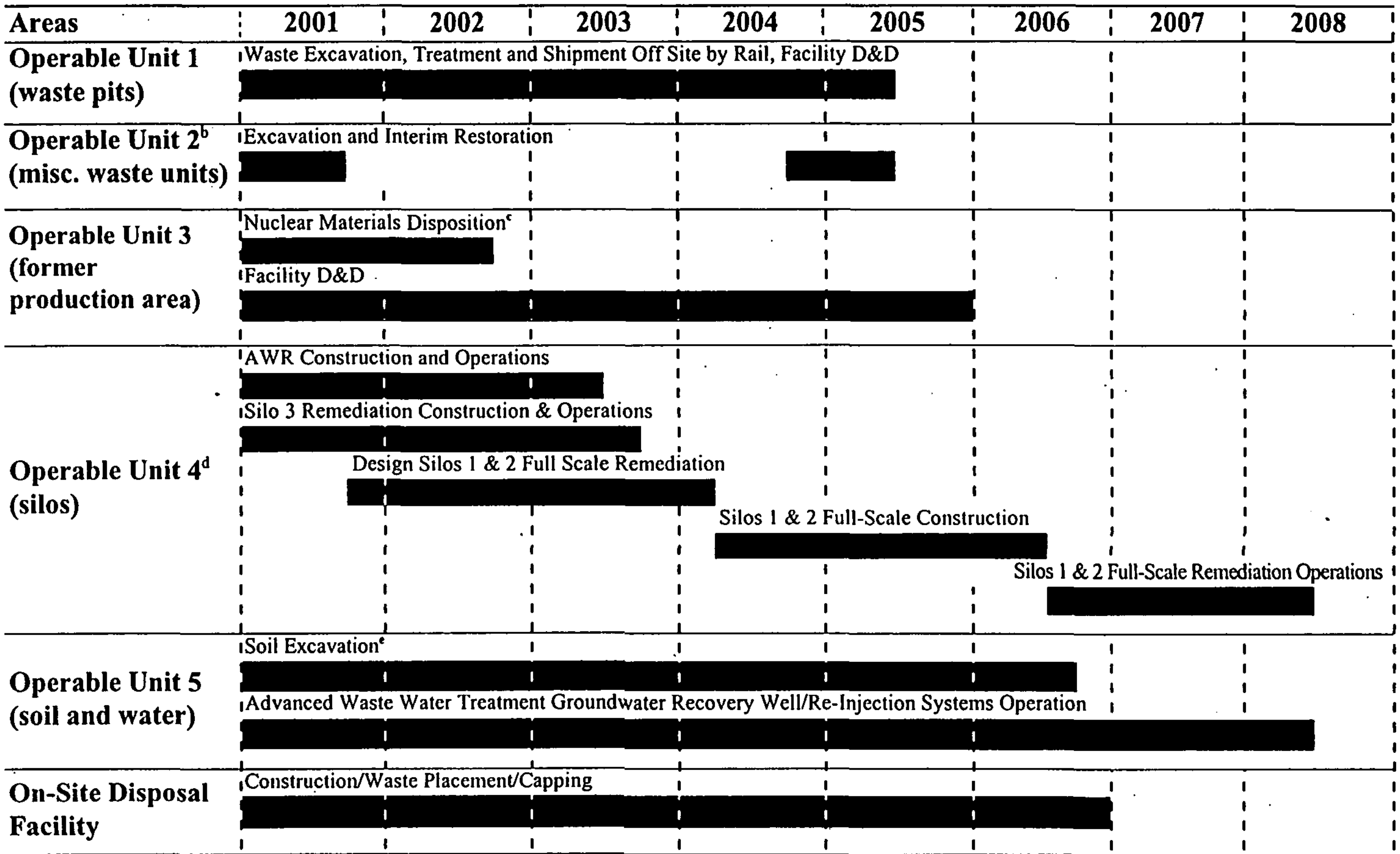
FIGURE 2-1

FEMP ACCELERATED REMEDIATION CASE MASTER SCHEDULE[a]



[a]Based on site Master Schedule, May 2000 status

[b]Includes excavation of the southern waste units and the lime sludge ponds in 2001, and the sanitary waste landfill in 2004 and 2005

[c]Nuclear materials disposition included only product materials at the time the Operable Unit 3 Record of Decision was signed. Some of these nuclear materials have been reclassified as uranium waste, and disposition has been scheduled separately from the product materials.

[d]Operable Unit 4 Record of Decision Amendment, scheduled to be submitted to EPA in 2000, may affect technical approach and schedule.

[e]Includes activities through interim restoration. Activities projected through Area 6 interim restoration; does not include excavation of Area 7 or the corridors (Area 10).

adopted sitewide remedy is well reasoned, cost effective, and ensures long-term protection of human health and the environment. Realignment into project organizations reflects the actual work processes and operations to be performed during remediation, and does not alter the requirements of the records of decision for each of the FEMP's operable units. Table 2-1 provides the crosswalk between each operable unit remedy and the FEMP's project organizations' responsibilities for implementing each remedy. The project organizations with primary responsibilities for CERCLA remediation are as follows:

- Waste Pits Remedial Action Project: This work scope includes the completion of remedial actions for the excavation, drying (as required), loading, and rail transport of contents of waste pits 1-6, the burn pit, and the clearwell to an off-site disposal facility, and responsibility for the off-site disposal of contaminated soil and debris that exceed the waste acceptance criteria for the on-site disposal facility.

- Soil and Disposal Facility Project: This project is responsible for the completion of remedial actions to address contaminated soil at the FEMP and miscellaneous waste units including the South Field, flyash piles, lime sludge ponds, and the solid waste landfill; also excavation/removal of building foundations, roadways, underground utilities and piping systems, and sitewide restoration activities and management of perched water encountered during remediation. This project is also responsible for the design, installation, and closure of the on-site disposal facility. Oversight of waste acceptance criteria compliance is provided by Waste Acceptance Operations.

- Demolition Projects: This work scope includes facility shutdown and decontamination and dismantling of the above-grade portion of the former uranium processing facilities and all treatment facilities used to support remedial actions of other operable units; also responsible for disposal of all generated debris, either on site or off site based on associated waste acceptance criteria.

- Silos Project: This project oversees the completion of remedial actions for the contents of Silos 1-3, including the retrieval, stabilization, and transport of the inventoried residues for off-site disposal.

- Aquifer Restoration and Wastewater Project (ARWWP): This project is responsible for the completion of activities necessary to restore the water quality in the affected portions of the Great Miami Aquifer including the pumping, treating, re-injecting, and discharging of extracted groundwater. This project will continue to maintain responsibility for groundwater modeling, monitoring, and reporting. This project is also responsible for the design, construction, and operation of all conveyance, treatment, and discharge systems for groundwater, wastewater, and storm water at the FEMP. ARWWP is also responsible for on-site disposal facility leak detection monitoring program and for monitoring leachate (quantity and quality) generated in the on-site disposal facility. Note that wastewater from individual projects may require project-specific pre-treatment and transportation to one of the ARWWP treatment head works. This will be determined in conjunction with ARWWP, on a project by project basis.

TABLE 2-1

FEMP OPERABLE UNIT REMEDIES AND ASSOCIATED PROJECT RESPONSIBILITIES

Operable Unit	Description	Remedy Overview[a]	Project Organization/Responsibilities
1	• Waste Pits 1 – 6 • Clearwell • Burn pit • Berms, liners, caps, and soil within the boundary	Record of Decision Approved: March 1995 Excavation of materials with constituents of concern above FRLs, waste processing and treatment by thermal drying (as necessary), off-site disposal at a permitted facility, and FEMP remediation	Waste Pits Remedial Action Project is responsible for rail upgrades, excavation of Operable Unit 1 waste units, waste processing and drying, loading, rail transport, and off-site disposal of contaminated soil and debris that exceed the waste acceptance criteria for the on-site disposal facility. (Note: Some of the activities with this project are being performed by International Technology Corporation.) Soil and Disposal Facility Project is responsible for directing excavation and certification of contaminated soil beneath the waste pits, as well as at- and below-grade remediation facilities, including the railroad. Aquifer Restoration and Wastewater Project is responsible for final treatment of contaminated runoff, perched water collected during waste pit excavation, and processing wastewater discharges. Each project is responsible for transporting remediation wastewater to the head works of the advanced wastewater treatment facility for treatment. Demolition Projects is responsible for decontamination and dismantling of Operable Unit 1 remediation facilities not specifically the responsibility of the Waste Pits Remedial Action Project subcontractor.
2	• Solid waste landfill • Inactive flyash pile • Active flyash pile (now inactive) • North and south lime sludge ponds • Other South Field disposal areas • Berms, liners, and soil within the operable unit boundary	Record of Decision Approved: May 1995 Excavation of all materials with constituents of concern above FRLs, treatment for size reduction and moisture control as required, on-site disposal in the on-site disposal facility, off-site disposal of a small fraction of excavated material that exceeds the waste acceptance criteria for the on-site disposal facility and lead-contaminated soil from the South Field firing range, and FEMP remediation	Soil and Disposal Facility Project is responsible for excavating and disposing of waste from all Operable Unit 2 subunits and certifying the footprints. This project is also responsible for the ongoing design, construction, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes; Operable Unit 5 soil and debris, and Operable Unit 3 debris. Waste Acceptance Operations is responsible for field oversight of soil excavations, for reviewing and signing manifests for impacted material delivered to the on-site disposal facility for placement, and for rejecting any unacceptable shipments. Aquifer Restoration and Wastewater Project is responsible for treating contaminated runoff and perched water collected during excavation of Operable Unit 2 subunit wastes. This project is also responsible for leachate and leak detection monitoring at the on-site disposal facility and for treating leachate from the on-site disposal facility. Each project is responsible for transporting remediation wastewater to the head works of the advanced wastewater treatment facility for treatment. This project is also responsible for monitoring leachate within the facility and perched groundwater in the till below the facility.

TABLE 2-1
(Continued)

Operable Unit	Description	Remedy Overview[a]	Project Organization/Responsibilities
3	Former production area, associated facilities, and equipment (includes all above- and below-grade improvements) including, but not limited to: • All structures, equipment, utilities, effluent lines, and K-65 transfer line • Wastewater treatment facilities • Fire training facilities • Scrap metals piles • Drums, tanks, solid waste, waste product, feedstocks, and thorium	Record of Decision Approved: September 1996 Adoption of Operable Unit 3 Interim Record of Decision; alternatives to disposal through the unrestricted or restricted release of materials, as economically feasible for recycling, reuse, or disposal; treatment of material for on- or off-site disposal; required off-site disposal for process residues, product materials, process-related metals, acid brick, concrete from specific locations, and any other material exceeding the on-site disposal facility waste acceptance criteria; and on-site disposal for material that meets the on-site disposal facility waste acceptance criteria	Demolition Projects is responsible for decontamination and dismantling of all above-grade portions of buildings and facilities at the FEMP. Soil and Disposal Facility Project is responsible for excavation and certification of soil beneath facilities and for removal of at- and below-grade structures. This project is also responsible for design, construction, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil, and Operable Unit 3 debris. Waste Acceptance Operations is responsible for reviewing facility decontamination and dismantling planning documents. This organization is also responsible for field oversight of debris sizing, segregation of on-site disposal facility material categories, and prohibited items; completing field tracking logs; completing manifests for material bound for the on-site disposal facility; and compiling final records of decontamination and dismantling debris placed in the on-site disposal facility. Aquifer Restoration and Wastewater Project is responsible for treating decontamination and other wastewaters during decontamination and dismantling activities and processing wastewater discharges; each decontamination and dismantling project is responsible for transporting remediation wastewater to the head works of the advanced wastewater treatment facility for treatment.
4	• Silos 1 and 2 (containing K-65 residues) • Silo 3 (containing cold metal oxides) • Silo 4 (empty and never used) • Decant tank system • Berms and soil within the operable unit boundary	Record of Decision Approved: December 1994 Silos 1 and 2: Submit Record of Decision Amendment to EPA: December 2000 Silo 3: Explanation of Significant Differences Approved: March 1998 Removal of Silo 3 materials and Silos 1 and 2 residues and decant sump tank sludges with on-site stabilization of materials, residues, and sludges followed by off-site disposal; demolition and decontamination, to the extent possible, of silos and remediation facilities; excavation of contaminated soil above the FRLs with on-site disposal for contaminated soils and debris that meet the on-site disposal facility waste acceptance criteria; and site restoration. Concrete from Silos 1 and 2, and contaminated soil and debris that exceed the on-site disposal facility waste acceptance criteria will be disposed of off site.	Silos 1 and 2 Project is responsible for transfer of Silos 1 and 2 residues to temporary transfer tanks, treatment, and transport off site. Infrastructure and support systems such as roads and utilities will be completed to support the final remediation of the silos. Silo 3 Project is responsible for Silo 3 content removal, treatment, and transport off site. Soil and Disposal Facility Project is responsible for certification, excavation, and disposition of contaminated soil beneath the silos and for removal of subsurface structures (i.e., sub-grade silo decant system). The project is also responsible for design, construction, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil, and Operable Unit 3 debris. Aquifer Restoration and Wastewater Project is responsible for treating decontamination and other wastewaters during decontamination and demolition activities; each project is responsible for capturing and transporting remediation wastewater to the head works of the advanced wastewater treatment facility for treatment. Demolition Projects is responsible for decontamination and dismantling of all Operable Unit 4 remediation facilities and associated above ground pipings.

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TABLE 2-1
(Continued)

Operable Unit	Description	Remedy Overview[a]	Project Organization/Responsibilities
5	• Groundwater • Surface water and sediments • Soil not included in the definitions of Operable Units 1 through 4 • Flora and fauna	Record of Decision Approved: January 1996 Extraction of contaminated groundwater from the Great Miami Aquifer to meet FRLs at all affected areas of the aquifer. Treatment of contaminated groundwater, storm water, and wastewater to attain concentration and mass-based discharge limits and FRLs in the Great Miami River. Excavation of contaminated soil and sediment to meet FRLs. Excavation of contaminated soil containing perched water that presents an unacceptable threat, through contaminant migration, to the underlying aquifer. On-site disposal of contaminated soil and sediment that meet the on-site disposal facility waste acceptance criteria. Soil and sediment that exceed the waste acceptance criteria for the on-site disposal facility will be treated, when possible, to meet the on-site disposal facility waste acceptance criteria or will be disposed of at an off-site facility. Also includes site restoration, institutional controls, and post-remediation maintenance	<u>Aquifer Restoration and Wastewater Project</u> is responsible for designing, installing, and operating the extraction/re-injection systems for Great Miami Aquifer groundwater restoration. This project is responsible for groundwater monitoring in the Great Miami Aquifer; reporting on the progress of aquifer restoration; designing, constructing, and operating all treated effluent discharge systems, and treating and discharging contaminated groundwater, storm water, and remediation wastewaters at the FEMP. This project is also responsible for operation, maintenance, and monitoring of the on-site disposal facility leachate collection system and leak detection system. <u>Soil and Disposal Facility Project</u> is responsible for certification of sitewide soil; excavation and disposition of contaminated soil, sediment, perched groundwater and at- and below-grade structures; and final site restoration. The project is also responsible for design, installation, and closure of the on-site disposal facility that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil, and Operable Unit 3 debris. <u>Waste Acceptance Operations</u> is responsible for reviewing Soils and Disposal Facility Project planning documents. This project is also responsible for oversight of field excavations, segregation on-site disposal facility material categories, and segregating prohibited items; completing field tracking logs; completing manifests for material bound for the on-site disposal facility; and compiling final records of soil and at- and below-grade debris placed in the on-site disposal facility. <u>Demolition Projects</u> is responsible for decontamination and dismantling of all Operable Unit 5 remediation facilities.

[a]Source of information is each operable unit's record of decisions and remedial design documents.

While this realignment facilitates efficient implementation of the FEMP remedial strategy, it will not affect cleanup levels that the U.S. Department of Energy is required to meet. All final remediation levels (FRLs) identified in each operable unit's record of decision will be addressed for all media.

2.2 GENERAL REMEDIATION ACTIVITIES

As indicated in Table 2-1, there are several similar large-scale field activities, some of which are underway or completed, that will occur over the life of each remediation project. These activities include site preparation; excavation/retrieval; construction; remedial facility operation; wastewater management and treatment; transportation of waste materials; on-site disposal facility development, waste placement, and capping; decontamination and dismantling, and safe shutdown; and site restoration. Each field activity has associated monitoring implications, as described below:

- Site Preparation: Extensive site preparation activities, such as excavation of borrow areas and development of roads (e.g., the haul road completed in 1998); as well as project-specific preparations for development of laydown areas and soil stockpile areas, and construction of remedial facilities

- Waste Excavation/Retrieval and Soil Excavation: Excavation is underway to remove all constituents of concern above FRLs. The movement of waste and soil will create dust throughout remediation. The following locations will be excavated: in Operable Unit 1, each of the waste pits, the clear well, and the burn pit; in Operable Unit 2, the solid waste landfill, inactive and active flyash piles, lime sludge ponds, the South Field, and all Operable Unit 2 associated berms and liners; and in Operable Unit 5 (underway), all affected contaminated soil (including affected soils beneath demolished structures in Operable Units 3 and 4) on the FEMP property. In addition, the contents of Silos 1, 2, and 3 will be retrieved.

- Construction of Remedial Facilities: Construction involves large-scale movement of materials, generation of dust, and development of project-specific controls such as collection of storm water runoff. Remedial facilities will be constructed to support three remedies: 1) a waste processing and treatment facility to dry and segregate waste pit waste will be constructed in the waste storage area; 2) stabilization facilities will be built near the silos; and 3) the advanced wastewater treatment facility expansion (completed in 1998) to handle increased capacities of water generated during site remediation.

- Operation of Remedial Facilities: The remediation facilities that will be constructed will operate during most of the remediation project life. They will require controls and monitoring for point-source air emissions and surface water. The facility that will handle waste pit materials will include the capability to sort, crush, size, and shred the waste, as well as treatment by thermal drying. Stabilization facilities will be built to treat Silos 1 and 2 contents and decant sludges, and Silo 3 contents.

- Wastewater Management: Wastewater generated during remediation must be collected, monitored, discharged, and if necessary, transported for treatment at one of the designated wastewater treatment facilities. Wastewaters include pumped groundwater, decontamination water, storm water, and other wastewaters.

- Transportation of Treated and Untreated Waste to On- and Off-site Disposal Facilities: All materials and soils with constituents of concern above FRLs on the FEMP property will be transported following excavation, treatment, or both, to on- or off-site disposal facilities. This activity will generate dust throughout the life of the remediation.

- Decontamination and Dismantling: Along with all facilities in the former production area, all facilities constructed to implement remedies will undergo decontamination and dismantling. Decontamination and dismantling, which is already in progress within the former production area, will continue throughout the life of the remediation.

- Site Restoration: Once all facilities have undergone decontamination and dismantling, the 1,050-acre site will be restored. This activity will involve movement and grading of soil, planting/seeding native vegetation, and related activities.

2.3 TWO-YEAR PROJECTION OF REMEDIATION FIELD ACTIVITIES

The two-year IEMP focus and revision schedule limits the uncertainties associated with long-range project planning and provides flexibility to customize monitoring programs to align with the current mix of remediation activities and actively incorporate stakeholder input. Table 2-2 and Figure 2-2 identify remediation field activities for this two-year period (excluded are document submittals, design submittals, and certification activities).

This two-year focus on remediation activities provides the basis to estimate monitoring needs, both on a project-specific and sitewide basis. The scope of the activities detailed above was a fundamental consideration in developing the IEMP monitoring approach and media-specific sampling programs.

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TABLE 2-2

FEMP INTEGRATED REMEDIATION FIELD ACTIVITIES FOR 2001 AND 2002[a]

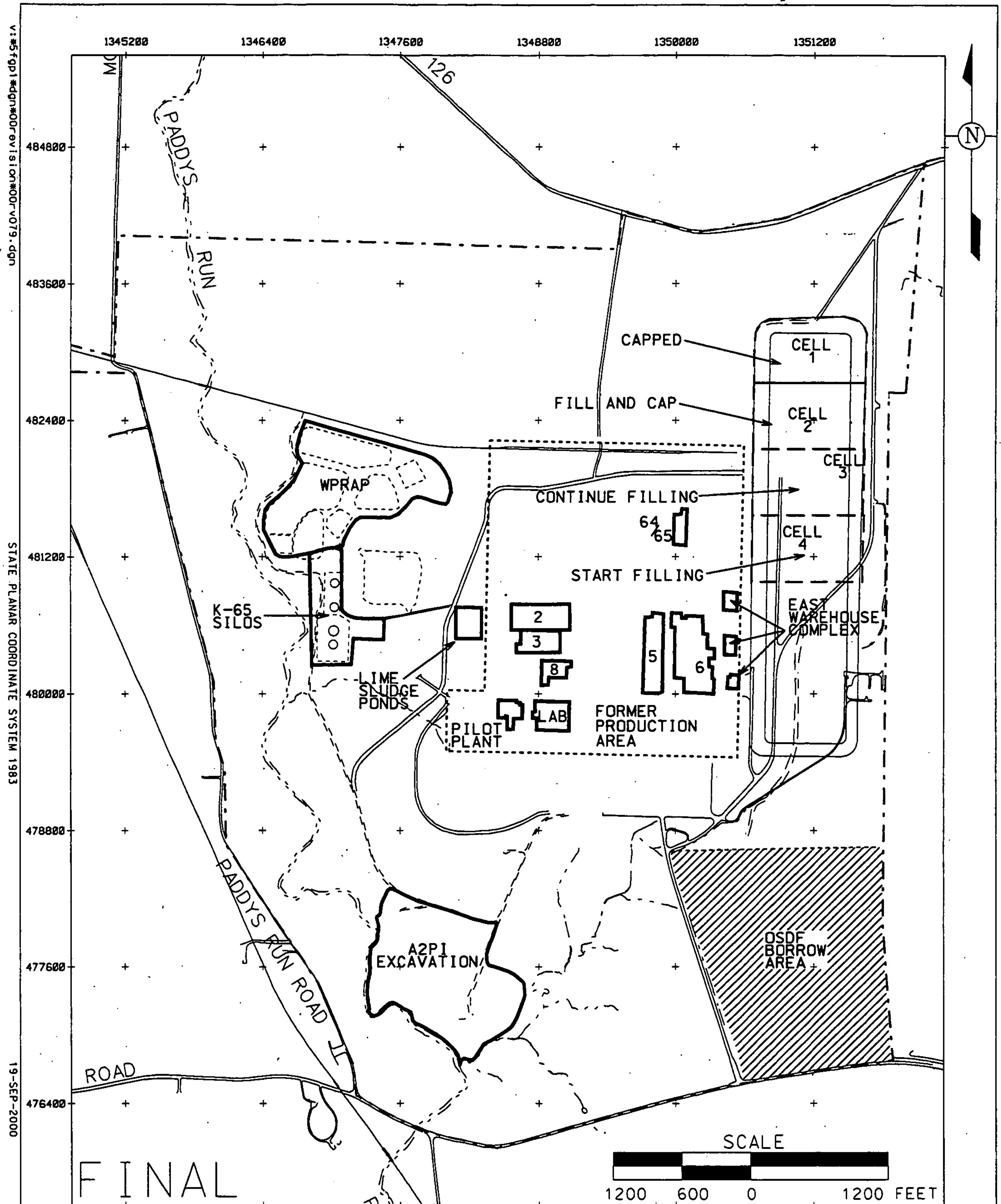
Remediation Project	2001	2002
Waste Pits Remedial Action Project	Continue waste excavation, treatment, shipment, and off-site disposal by rail	Continue waste excavation, treatment, shipment, and off-site disposal by rail
Soil and Disposal Facility Project	Continue and complete Area 1, Phase III Part 1 excavation Continue and complete Area 1, Phase II and Area 2, Phase I excavation Begin Area 3A excavation Begin and complete Lime Sludge Ponds excavation Complete Cell 1 cap Continue Cell 2 impacted material placement Continue Cell 3 impacted material placement	Complete Area 3A excavation Continue Cell 2 impacted material placement Begin Cell 2 cap Continue Cell 3 impacted material placement Begin and complete Cell 4 liner construction Begin Cell 4 impacted material placement
Aquifer Restoration and Wastewater Project	Sitewide environmental monitoring Continue operation of water treatment facilities Continue South Plume Module extraction well operations Continue Re-Injection Module well operations Continue South Field Module extraction well operations Installation and maintenance of supplemental extraction/re-injection wells (as necessary) Continued collection and treatment of storm water (as necessary) and wastewater Continued on-site disposal facility leak detection and leachate monitoring	Sitewide environmental monitoring Continue operation of water treatment facilities Continue South Plume Module extraction well operations Continue Re-Injection Module well operations Continue South Field Module extraction well operations Installation and maintenance of supplemental extraction/re-injection wells (as necessary) Continued collection and treatment of storm water (as necessary) and wastewater Continued on-site disposal facility leak detection and leachate monitoring

TABLE 2-2
(Continued)

Remediation Project	2001	2002
Demolition Projects	Continue utility relocations <u>Facilities Shutdown</u> Begin and complete East Warehouse Complex Begin and complete isolation of Buildings 64&65 <u>Decontamination and Dismantling</u> Complete Plant 6/East Warehouse Complete Plant 5	Continue utility relocations <u>Facilities Shutdown</u> Begin and complete Liquid Storage Complex Begin and complete Plant 1 Phase II satellite buildings utility disconnects <u>Decontamination and Dismantling</u> Begin and complete Multi-complex (Plant 2, 3, 8, General Sump and Liquid Storage) Begin and complete Pilot Plant/Lab
Silos Projects	Silo 3 Construction and Startup Silos 1 and 2 Accelerated Waste Retrieval Full Scale Mockup Operations and Phase I Radon Control System Startup	Silo 3 Operations Silos 1 and 2 Accelerated Waste Retrieval Radon Control System Phase II and Waste Retrieval Operations

[a]All schedule information is based on the Fluor Fernald Master Schedule, May 2000 status.

000035



LEGEND:

FEMP BOUNDARY

WPRAP EXCAVATION, TREATMENT AND OFF-SITE DISPOSAL OF WASTE PIT MATERIALS

K-65 SILOS (CONSTRUCTION)

NOTE:
DECONTAMINATION AND DISMANTLING OF COMPLEXES (IDENTIFIED BY PLANT NUMBERS)

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FIGURE 2-2. FEMP REMEDIATION ACTIVITIES FOR 2001 AND 2002

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Section 3.0

3.0 GROUNDWATER MONITORING PROGRAM

Section 3.0 presents the monitoring strategy for tracking the progress of the restoration of the Great Miami Aquifer and satisfying the Fernald Environmental Management Project's (FEMP's) site-specific commitments related to groundwater monitoring. A media-specific plan for conducting all groundwater monitoring activities is provided. Program expectations for 2001 and 2002 are outlined in Section 3.4, and the program design for 2001 and 2002 is presented in Section 3.5.

3.1 INTEGRATION OBJECTIVES FOR GROUNDWATER

The Integrated Environmental Monitoring Plan (IEMP) is the primary vehicle for tracking the performance of the full-scale Great Miami Aquifer groundwater restoration remedy being implemented under Operable Unit 5. The strategy and technical approach will be expanded to encompass each of the new groundwater extraction and re-injection modules that are scheduled to be brought on line over the life of the remedy. Aquifer restoration modules include:

- The South Plume Module
- The Re-Injection Module (formerly called the Re-Injection Demonstration Module)
- The South Field Extraction (Phase I and II) Modules
- The Waste Storage Area Module.

In this version of the IEMP, the South Plume Module refers to six extraction wells. Four of the six extraction wells (originally called the South Plume Module) have been in operation since 1993 as part of a removal action. In 1998 two additional extraction wells became operational just north of the four original South Plume wells under a project known as the South Plume Optimization Module. All six wells now comprise the South Plume Module. As a result of a conceptual design groundwater characterization conducted in the waste storage and Plant 6 areas in late 1999 and early 2000, the 20 micrograms per liter (μg/L) total uranium plume in the Plant 6 area was not detected. It is believed that the plume has dissipated to concentrations that are below 20 μg/L. Because a uranium plume with concentrations above 20 μg/L is no longer present in the Plant 6 area, a restoration module for this area is no longer planned. However, groundwater monitoring will continue in the Plant 6 area. The Re-Injection Demonstration Module has been renamed to the Re-Injection Module to reflect completion of the demonstration. An overview of each of the modules listed above is provided in Section 3.4 and Figure 3-1 identifies the location of these aquifer restoration modules.

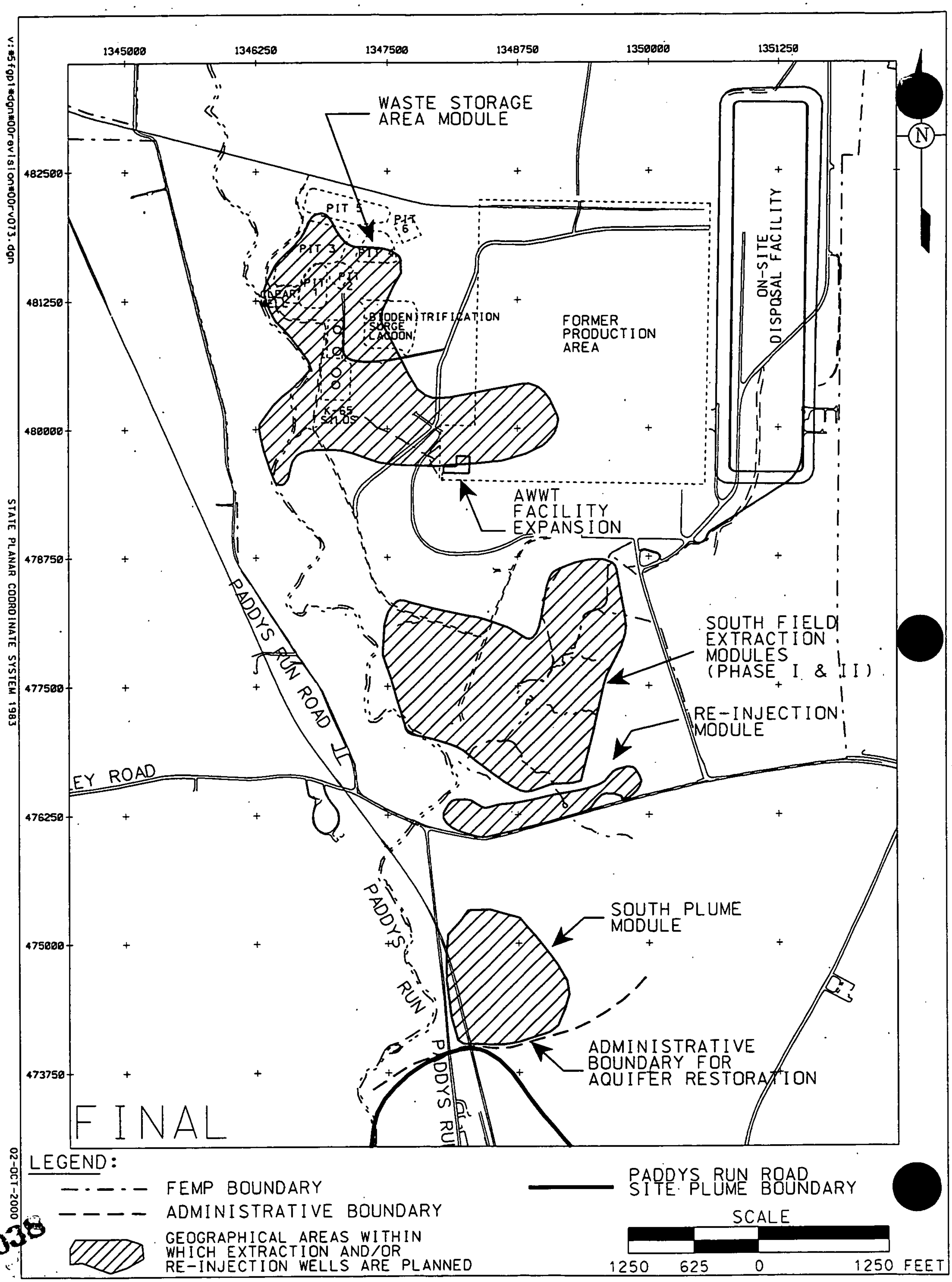

FIGURE 3-1. LOCATION OF AQUIFER RESTORATION MODULES

The current focus of the monitoring program is to address remedy performance tracking responsibilities for 2001 and 2002. The design of the groundwater monitoring program for 2001 and 2002 was developed (i.e., well monitoring coverage) in recognition of:

- Operation of the South Field Extraction (Phase I) Module
- Operation of the South Plume Module
- Operation of the Re-Injection Module
- Waste excavation activities in the southern waste units
- Waste excavation activities associated with Operable Unit 1
- Silos project activities
- Possible operation of early start extraction wells in the Pilot Plant Drainage Ditch area.

Ultimately, the IEMP will be used to document the approach for determining when the various modules can be removed from service, once remedial action objectives for the Great Miami Aquifer provided in the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b) are achieved. The IEMP will later serve as the vehicle for verifying the completion of the aquifer restoration. The sampling strategy that will be used to verify completion will be described in future revisions to the IEMP.

Along with this performance-based responsibility, the IEMP also serves to integrate several former compliance-based groundwater monitoring or protection programs:

- Ohio Environmental Protection Agency (OEPA) Director's Findings and Orders for property boundary groundwater monitoring to satisfy Resource Conservation and Recovery Act (RCRA) facility groundwater monitoring requirements

- Private well sampling

- Groundwater Protection Management Program Plan.

As discussed in Section 3.7, these multiple activities were brought together under a single reporting structure to facilitate regulatory agency review of the progress of the Operable Unit 5 groundwater remedy.

3.2 SUMMARY OF REGULATORY DRIVERS, DOE POLICIES, AND OTHER FEMP-SPECIFIC AGREEMENTS

This section presents a summary evaluation of the regulatory-based requirements and policies governing monitoring of the Great Miami Aquifer. The intent of the section is to identify the pertinent regulatory drivers, including applicable or relevant and appropriate requirements (ARARs) and to be considered -based requirements, for the scope and design of the Great Miami Aquifer groundwater monitoring system. These requirements will be used to confirm that the program design will satisfy the regulatory obligations for monitoring that have been activated by the Operable Unit 5 Record of Decision and achieve the intentions of other pertinent criteria, such as U.S. Department of Energy (DOE) Orders and the FEMP's existing agreements, as appropriate that have a bearing on the scope of groundwater monitoring.

The results of the analysis will also be used to define, as appropriate for this media, the administrative boundaries between the IEMP and the project-specific source control monitoring conducted by other FEMP organizations.

3.2.1 Approach

The analysis of the regulatory drivers and policies for groundwater monitoring was conducted by examining the suite of ARARs and to be considered-based requirements in the FEMP's approved Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) operable unit's record of decision to identify the subset with specific groundwater monitoring requirements. The FEMP's existing compliance agreements issued outside the CERCLA process, such as the September 10, 1993, OEPA Director's Findings and Orders (OEPA 1993), were also reviewed.

3.2.2 Results

The following regulatory drivers, compliance agreements, and DOE policies were found to govern the monitoring scope and reporting requirements for remedy performance monitoring and general surveillance of the protectiveness of the Great Miami Aquifer groundwater remedy:

- The CERCLA Record of Decision for Remedial Actions at Operable Unit 5 requires the extraction and treatment of Great Miami Aquifer groundwater above final remediation levels (FRLs) until the full beneficial use potential of the aquifer is achieved, including use as a drinking water source. The FRLs are established by considering chemical-specific ARARs, hazard indices, background, and detection limits for each contaminant. Many Great Miami Aquifer FRLs are based on established or proposed Safe Drinking Water Act maximum contaminant levels (MCLs), which are ARARs for groundwater remediation. For those FEMP-related contaminants that do not have an established MCL under the Safe Drinking Water Act, a concentration equivalent to an incremental lifetime cancer risk of 10^{-5} for carcinogens or a hazard quotient of one for noncarcinogens was used as the FRL, unless background concentrations or detection limits are such that health-based limits could be attained (in these cases the background or detection limit became the FRL). The FRLs will be tracked throughout all affected areas of the aquifer and will be the basis for determining when the Great Miami Aquifer restoration objectives have been met. By definition, the Operable Unit 5 Record of Decision incorporates the requirements of the FEMP's existing CERCLA South Plume Removal

Action (which was the regulatory driver for the FEMP's former Design Monitoring and Evaluation Program Plan Groundwater Monitoring and Reporting Program).

- The September 10, 1993, OEPA Director's Findings and Orders, which required groundwater monitoring at the FEMP's property boundary to satisfy RCRA facility groundwater monitoring requirements have been superceded by Directors Final Findings and Orders, issued September 7, 2000. The September 7, 2000 Directors Final Findings and Orders specify that the site's groundwater monitoring activties will be implemented in accordance with the IEMP. The revised language allows modification of the groundwater monitoring program as necessary, via the IEMP revision process, without issuance of a new order.

- DOE Order 5400.1, General Environmental Protection Program, which establishes the requirement for a Groundwater Protection Management Program Plan (GPMPP) for DOE facilities. The required informational elements of a GPMPP are fulfilled by the Remedial Investigation and Feasibility Study Reports for Operable Unit 5. The groundwater monitoring program requirement is being fulfilled by the IEMP.

- DOE Order 5400.5, Radiation Protection of the Public and Environment, which establishes radiological dose limits and guidelines for the protection of the public and environment. Demonstration of compliance with these limits and guidelines for radiological dose are generally based on calculations that make use of information obtained from the FEMP's monitoring and surveillance program. This program is based on guidance in the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE 1991). The FEMP's private well sampling program for the Great Miami Aquifer (that previously was in the Fernald Site Environmental Monitoring Plan [FERMCO 1995]) is conducted to satisfy the intention of this DOE Order with respect to groundwater. While most private well water users in the affected area are now provided with a public water supply, a limited private well sampling activity will be maintained to supplement the groundwater monitoring network provided by monitoring wells.

- The 1986 Federal Facilities Compliance Agreement, which requires that the FEMP maintain a sampling program for daily flow and uranium concentration of discharges to the Great Miami River and report the results quarterly to the U.S. Environmental Protection Agency (EPA), OEPA, and Ohio Department of Health. The sampling program conducted to address this requirement has been modified over the years and is currently governed by an agreement reached with EPA and OEPA in early 1996. For groundwater, this agreement is specifically related to the South Plume wellfield to quantify the amount of uranium removed and total volume of groundwater extracted.

The groundwater monitoring plan provided in this IEMP has been developed in full consideration of the above regulatory drivers. Each of these drivers and the associated monitoring conducted to comply with these drivers is listed in Table 3-1. Table 3-1 also lists each regulatory requirement for the on-site disposal facility groundwater monitoring program and the associated project-specific plan. Sections 3.7 and 8.0 outline the FEMP's current and long-range plan for complying with the reporting requirements contained within the IEMP drivers.

TABLE 3-1

**FEMP GROUNDWATER MONITORING PROGRAM
REGULATORY DRIVERS AND ACTIONS**

	DRIVER	ACTION
IEMP	CERCLA Record of Decision for Operable Unit 5	The IEMP describes routine monitoring to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer. The IEMP will be modified toward completion of the remedial action to include a sampling plan to certify achievement of the FRLs.
	OEPA Director's Final Findings and Orders; RCRA/Hazardous Waste Facility Groundwater Monitoring	The IEMP describes routine monitoring at wells located at the property boundary to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer.
	DOE Order 5400.1, Groundwater Protection Management Plan	The IEMP describes routine monitoring to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer.
	DOE Order 5400.5, Radiation Protection of Public and Environment	The IEMP describes monitoring private wells to support the annual dose assessment that evaluates the contribution of the groundwater pathway to the annual dose to the public.
	Federal Facilities Compliance Agreement Radiological Monitoring	The IEMP describes the routine sampling of the South Plume wellfield in terms of the total volume extracted and the amount of uranium removed.

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TABLE 3-1
(Continued)

	DRIVER	ACTION	PROJECT PLAN
PROJECT	OAC 3745-27-10, Ohio Solid Waste Disposal Facility Groundwater Monitoring	A leak detection monitoring program in the glacial overburden and the Great Miami Aquifer will be conducted for the on-site disposal facility.	Groundwater, leak detection, and leachate monitoring plan for the on-site disposal facility
	40 CFR 264.90-.99 (OAC 3745-54-90 through 99); 40 CFR 265.90-.94 (OAC 3745-65-90 through 94), RCRA/Ohio Hazardous Waste Disposal Facility Groundwater Monitoring	A leak detection monitoring program in the glacial overburden and the Great Miami Aquifer will be conducted for the on-site disposal facility.	Groundwater, leak detection, and leachate monitoring plan for the on-site disposal facility
	Uranium Mill Tailings Reclamation and Control Act Regulations Groundwater Monitoring for Disposal Facilities	A leak detection monitoring program in the Great Miami Aquifer will be conducted for the on-site disposal facility.	Groundwater, leak detection, and leachate monitoring plan for the on-site disposal facility
	DOE Order 5820.2A, Monitoring at Low-Level Radioactive Waste Disposal Facilities	A leak detection monitoring program in the Great Miami Aquifer will be conducted for the on-site disposal facility.	Groundwater, leak detection, and leachate monitoring plan for the on-site disposal facility
	OAC 3745-27-19(M)(4) and (5), Ohio Solid Waste Disposal Facility Leachate Detection and Collection Systems	Monitoring of on-site disposal facility leachate detection and collection systems is included in the on-site disposal facility leak detection monitoring program.	Groundwater, leak detection, and leachate monitoring plan for the on-site disposal facility

Project-specific groundwater monitoring is required only for one project -- the on-site disposal facility. The IEMP will not be utilized as the mechanism for conducting on-site disposal facility performance monitoring within the till and the Great Miami Aquifer. A leak detection monitoring program plan, which includes both leachate and groundwater monitoring as part of a leak detection program was separately submitted from the IEMP and approved by EPA and OEPA in 1997. The on-site disposal facility monitoring requirements include the regulatory drivers and the ARARs and to be considered-based criteria that have a bearing on the design and execution of a groundwater monitoring program for the on-site disposal facility and are listed below:

- Ohio Solid Waste Disposal Facility Groundwater Monitoring Rules, Ohio Administrative Code (OAC) 3745-27-10, which specify groundwater monitoring program requirements for sanitary landfills. These regulations describe a three-tiered program for detection, assessment, and corrective measures.

- RCRA/Ohio Hazardous Waste Groundwater Monitoring Requirements for Regulated Units, 40 Code of Federal Regulations (CFR) 264.90 through .99 (OAC 3745-54-90 through 99) and 40 CFR 265.90 through .94 (OAC 3745-65-90 through 94), which specify groundwater monitoring program requirements for surface impoundments, landfills, and land treatment units that manage hazardous wastes. Because the Ohio regulations are at least as stringent, and in some cases more stringent, they are the controlling regulations.

- Uranium Mill Tailings Reclamation and Control Act Regulations, 40 CFR 192.32(A)(2), which specify standards for uranium byproduct materials in piles or impoundments. This regulation requires conformance with the RCRA groundwater monitoring performance standard in 40 CFR 264.92. Compliance with RCRA/Ohio Hazardous Waste rules for groundwater monitoring will fulfill the substantive requirements for groundwater monitoring in the Uranium Mill Tailings Reclamation and Control Act regulations.

- DOE Order 5820.2A Chapter III.3.k, Environmental Monitoring, which requires low-level radioactive waste disposal facilities to perform environmental monitoring for all media, including groundwater. Compliance with RCRA/Ohio Hazardous Waste and Ohio Solid Waste rules for groundwater monitoring will fulfill the requirement for groundwater monitoring in this DOE Order.

- Ohio Solid Waste Disposal Facility Rules, OAC 3745-27-19(M)(4) and (5), which requires submittal of an annual operational report, including a summary of the quantity of leachate collected for treatment and disposal, location of leachate treatment, verification that the leachate management system is operating properly, and the results of analytical testing of an annual grab sample of leachate for groundwater monitoring constituents listed in Appendix I of OAC 3745-27-10.

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3.3 PROGRAMMATIC BOUNDARY FOR THE GROUNDWATER MONITORING PROGRAM

This section identifies the programmatic boundary(s) that have been established between the IEMP and the project-specific activities to be conducted by others. The intent behind the boundary definition is to clearly delineate the scope and geographic extent of the IEMP's monitoring responsibility and establish a recognized interface between the sitewide focus of the IEMP and the predominant emission control focus of project-specific monitoring.

The programmatic boundary for each of the FEMP's environmental media will be unique, and for certain media, time-dependent. One or more of the following defines the media-specific boundary:

- Regulatory monitoring requirements for the media
- Physical boundaries (i.e., geologic, hydrogeologic, or surface boundaries imposed by the remediation projects)
- Media-specific monitoring requirements specifically assigned to the IEMP by administrative decisions.

Because of these unique considerations, the boundary definitions are provided for each media to clearly convey the line of responsibility for that media under the IEMP. For groundwater, four programmatic boundaries require definition for the IEMP:

- The responsibility boundary between the Great Miami Aquifer and the perched groundwater remediation efforts
- The administrative boundary between the FEMP and the Paddys Run Road Site contaminant plumes (Figure 3-1)
- The responsibility boundary for performance monitoring of the on-site disposal facility between the Soil and Disposal Facility Project and the Aquifer Restoration and Wastewater Project
- The responsibility boundary between the Aquifer Restoration and Wastewater Project and the Operable Unit 1 waste pit remediation efforts.

3.3.1 Responsibility Boundary between Great Miami Aquifer and Perched Groundwater Remediation Efforts

For the FEMP's Great Miami Aquifer plume, all the geographic areas that are to be restored under the Operable Unit 5 Record of Decision (or routinely monitored beyond the restoration area) reside within the scope of the Aquifer Restoration and Wastewater Project. For the perched groundwater remediation, all remedial responsibilities reside within the Soil and Disposal Facility Project. The pre-certification and certification sampling activities that will accompany the excavation of affected perched groundwater zones (to demonstrate the attainment of cross-media based soil FRLs) will be performed by the Soil and Disposal Facility Project.

3.3.2 Administrative Boundary between the IEMP and Paddys Run Road Site Contaminant Plumes

As described in the Remedial Investigation Report for Operable Unit 5 (DOE 1995d) (Section 4.8.2), the Paddys Run Road Site consists of two facilities, Albright & Wilson Americas, Inc. and Ruetgers-Nease Chemical Company, Inc. Albright and Wilson occupies the northern portion of the site and manufactures phosphate compounds. The Paddys Run Road Site Remedial Investigation Report released in September 1992 documented releases to the Great Miami Aquifer of inorganics, volatile organic compounds, and semi-volatile organic compounds. The Proposed Plan for Operable Unit 5 (DOE 1995c), acknowledged that DOE's role and involvement in OEPA's ongoing assessment and/or cleanup of the Paddys Run Road Site plume, if any, would be separately defined as part of the Paddys Run Road Site response obligations and in accordance with the Paddys Run Road Site project schedule. Groundwater monitoring will continue south of the administrative boundary until such time as the need for action is established and implemented. This monitoring will assess the nature of the 20 μg/L uranium plume south of the administrative boundary and the impact that pumping of the South Plume extraction wells has on the Paddys Run Road Site plume. Monitoring is discussed further in Section 3.5.1.1.

3.3.3 Responsibility Boundary between the Soil and Disposal Facility Project and the Aquifer Restoration and Wastewater Project for Performance Monitoring at the On-Site Disposal Facility

Monitoring of the performance of the on-site disposal facility, including the monitoring of groundwater in the Great Miami Aquifer, is a project-specific responsibility of the Soil and Disposal Facility Project. The interpretation of groundwater data, in relation to the performance of the on-site disposal facility, is a joint responsibility of the Soil and Disposal Facility Project and the Aquifer Restoration and Wastewater Project. On-site disposal facility monitoring results will be reported on the IEMP Extranet Site and annual integrated site environmental reports. Evaluation of baseline conditions will be provided through technical memoranda.

3.3.4 Responsibility Boundary Between the Aquifer Restoration and Wastewater Project and the Operable Unit 1 Waste Pit Remediation Efforts

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Responsibility for remediation of the FEMP's Great Miami Aquifer plume specified to be restored under the Operable Unit 5 Record of Decision resides within the scope of the Aquifer Restoration and Wastewater Project. This includes the geographic area that is required to be restored as a result of contaminant migration (past and that occurring during remediation) from the Operable Unit 1 area. For the remediation of the waste pit contents (including pit leachate, surface water falling on the pit area, and perched water draining into the active excavation) remedial responsibilities reside within the Waste Pit Remedial Action Project. The pre-certification and certification sampling activities that will accompany the excavation of affected perched groundwater zones adjacent to the pits and affected subsoils below the pits (to demonstrate the attainment of cross-media-based soil FRLs) will be performed by the Soil and Disposal Facility Project.

3.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

3.4.1 Program Expectations

The IEMP groundwater monitoring program for 2001 and 2002 is designed to provide a comprehensive monitoring network that will track remedial wellfield operations and assess aquifer conditions. The expectations of the monitoring program are to:

- Provide groundwater data to assess the capture and restoration of the 20 μg/L total uranium plume
- Provide groundwater data to assess the capture and restoration of non-uranium FRL constituents
- Provide groundwater data to assess groundwater quality at the FEMP property boundary
- Provide groundwater data that are sufficient to verify remedy performance with respect to the performance predicted by groundwater modeling (verifying groundwater model predictions of remedy performance is further discussed in Section 3.7.1)
- Provide groundwater data to assess the impact that the aquifer restoration is having on the Paddys Run Road Site plume
- Continue to fulfill DOE Order 5400.1 requirements to maintain an environmental monitoring plan for groundwater
- Continue to address concerns of the community regarding the progress of the aquifer restoration.

Following active remediation, monitoring will be conducted to check for rebound and to certify cleanup. Design considerations for rebound and certification groundwater monitoring will be incorporated, where necessary, into later revisions to the IEMP. The following section provides the design considerations required to monitor remedy performance in 2001 and 2002.

3.4.2 Design Considerations

3.4.2.1 The Modular Approach to Aquifer Restoration

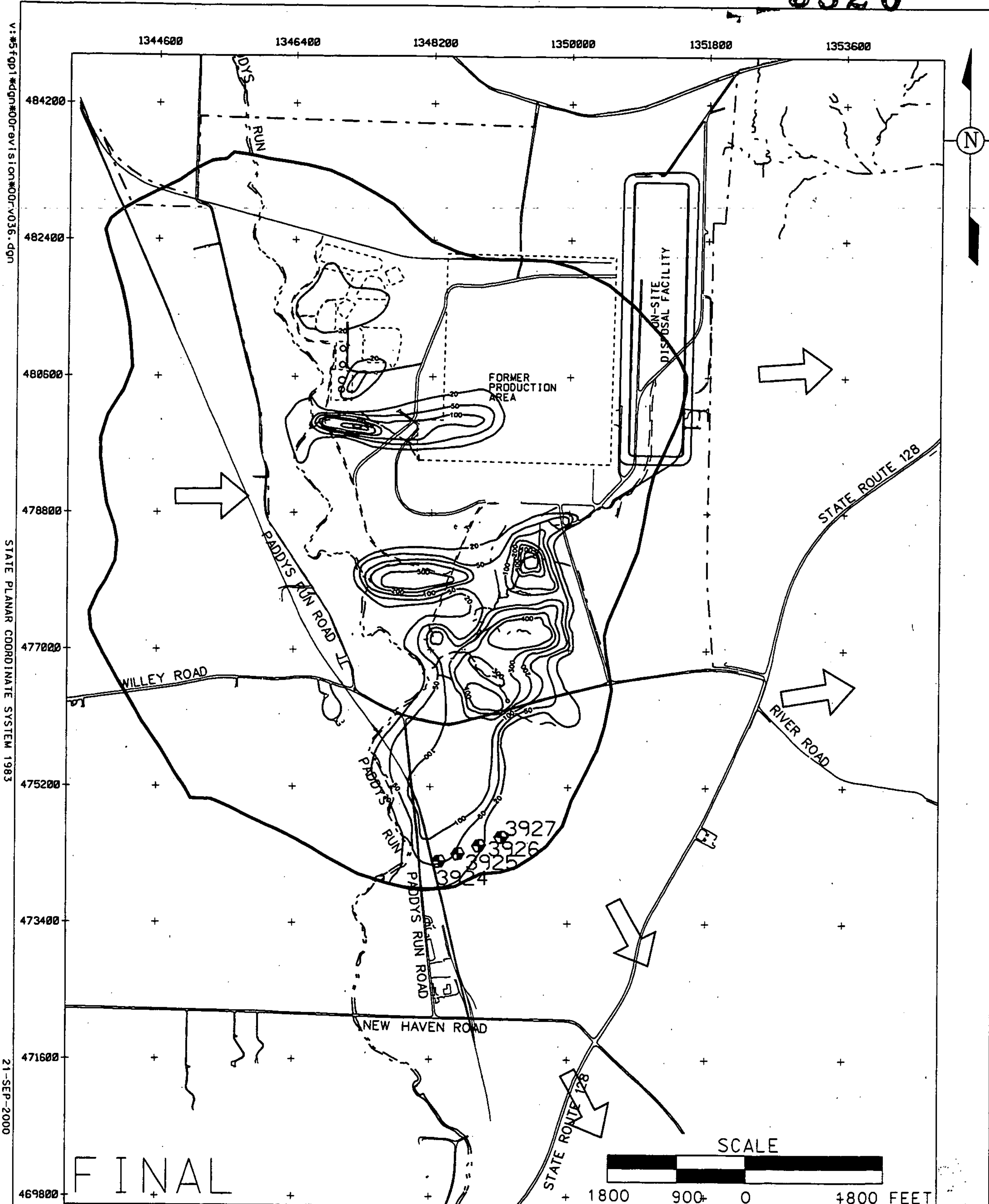
The Great Miami Aquifer is contaminated with uranium and other constituents from the FEMP. An extensive evaluation of the nature and extent of contamination in the Great Miami Aquifer can be found in the Remedial Investigation Report for Operable Unit 5. Uranium is the principal constituent of concern.

Figure 3-2 shows the maximum total uranium plume map (20 μg/L uranium or higher) as of the first quarter of 2000. The map represents a compilation of several different monitoring depths within the aquifer, and illustrates the maximum lateral extent of the plume at all depths. Over the majority of the plume, the top is situated at the water table. In some regions of the aquifer though, the top of the plume is situated below the water table. A more detailed presentation of the geometry of the uranium plume can be found in Appendix G of the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) (DOE 1997a), and the Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas (DOE 2000a).

The primary sources of contamination at the FEMP that contributed to the present geometry of the uranium plume include: 1) the waste pits in the waste storage area; 2) the inactive fly ash pile in the South Field area; 3) former production activities, deep soil and perched water contamination in the vicinity of Plant 6; and 4) the previously uncontrolled surface water runoff from the former production area that had direct access to the aquifer through the Pilot Plant Drainage Ditch, Storm Sewer Outfall Ditch, and Paddys Run.

A groundwater remediation strategy which relies on pump-and-treat and re-injection technology is being used to conduct a concentration-based clean up of the Great Miami Aquifer. The restoration strategy focuses primarily on the removal of uranium, but also has been designed to limit the further expansion of the plume, achieve removal of all targeted contaminants to concentrations below designated FRLs, and prevent undesirable draw down impacts beyond the FEMP property.

A groundwater re-injection demonstration was conducted at the FEMP from September 2, 1998, to September 2, 1999. The evaluation of re-injection technology at the FEMP was sponsored by the DOE's Office of Science and Technology Subsurface Contaminants Focus Area, at the request of the FEMP. The re-injection demonstration was deemed a success. Re-injection is currently being used to help accelerate the restoration from the 27 years presented in the Operable Unit 5 Record of Decision. Successful acceleration of the remedy is also contingent upon:



LEGEND:

FEMP BOUNDARY

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

EXTRACTION WELL

TOTAL URANIUM CONTOUR IN µg/L FROM FIRST QUARTER 2000 DATA

REGIONAL GROUNDWATER FLOW DIRECTION

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FIGURE 3-2. MAXIMUM TOTAL URANIUM PLUME MAP, FIRST QUARTER 2000

- Other operable units completing their accelerated clean-up objectives so that surface access is available for aquifer remediation wells
- The accelerated removal of sources which will allow extraction wells to be located closer to the center of uranium plumes

Modeled geochemical and hydraulic parameters being consistent with actual aquifer conditions. Restoration of the Great Miami Aquifer is being accomplished by using a series of area-specific groundwater restoration modules and a centralized water treatment facility (Figure 3-1). The design of the aquifer restoration system is presented in the Baseline Remedial Strategy Report. Area specific groundwater restoration modules include:

- The South Plume Module
- The Re-Injection Module
- The South Field Extraction (Phase I and II) Modules
- The Waste Storage Area Module.

Each area-specific module will be brought on line as scheduled during the life of the remedy, and withdrawn from service once remediation objectives within an area are achieved. In 2001 and 2002 the South Field Extraction (Phase I) Module, South Plume, and the Re-Injection Modules will all be operational. Figure 3-3 shows the location of the extraction and re-injection wells that comprise these modules. The South Field Extraction (Phase II) and Waste Storage Area Modules are not scheduled to be operational in either 2001 or 2002. An early start in the waste storage area may result in the operation of an extraction well near the Pilot Plant Drainage Ditch prior to 2003, which is the next formal 2-year IEMP revision date. Projected pumping and re-injection rates are presented in the Baseline Remedial Strategy Report.

Based on the findings of the Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas the uranium plume in the Plant 6 area has dissipated. Therefore, an aquifer restoration module is no longer planned for the Plant 6 area. Groundwater monitoring in the Plant 6 area will continue under the IEMP.

Groundwater modeling predicts that aquifer remedy pumping will create a hydraulic capture zone that is larger than the actual dimension of the 20 μg/L total uranium plume. This capture zone is called the 10-year, uranium-based restoration footprint. Figure 3-2 illustrates the relationship between the 10-year, uranium-based restoration footprint, which is predicted to exist when all planned restoration modules are operating consistent with the pumping schedules outlined in the Baseline Remedial Strategy Report, and the maximum 20 μg/L total uranium plume.

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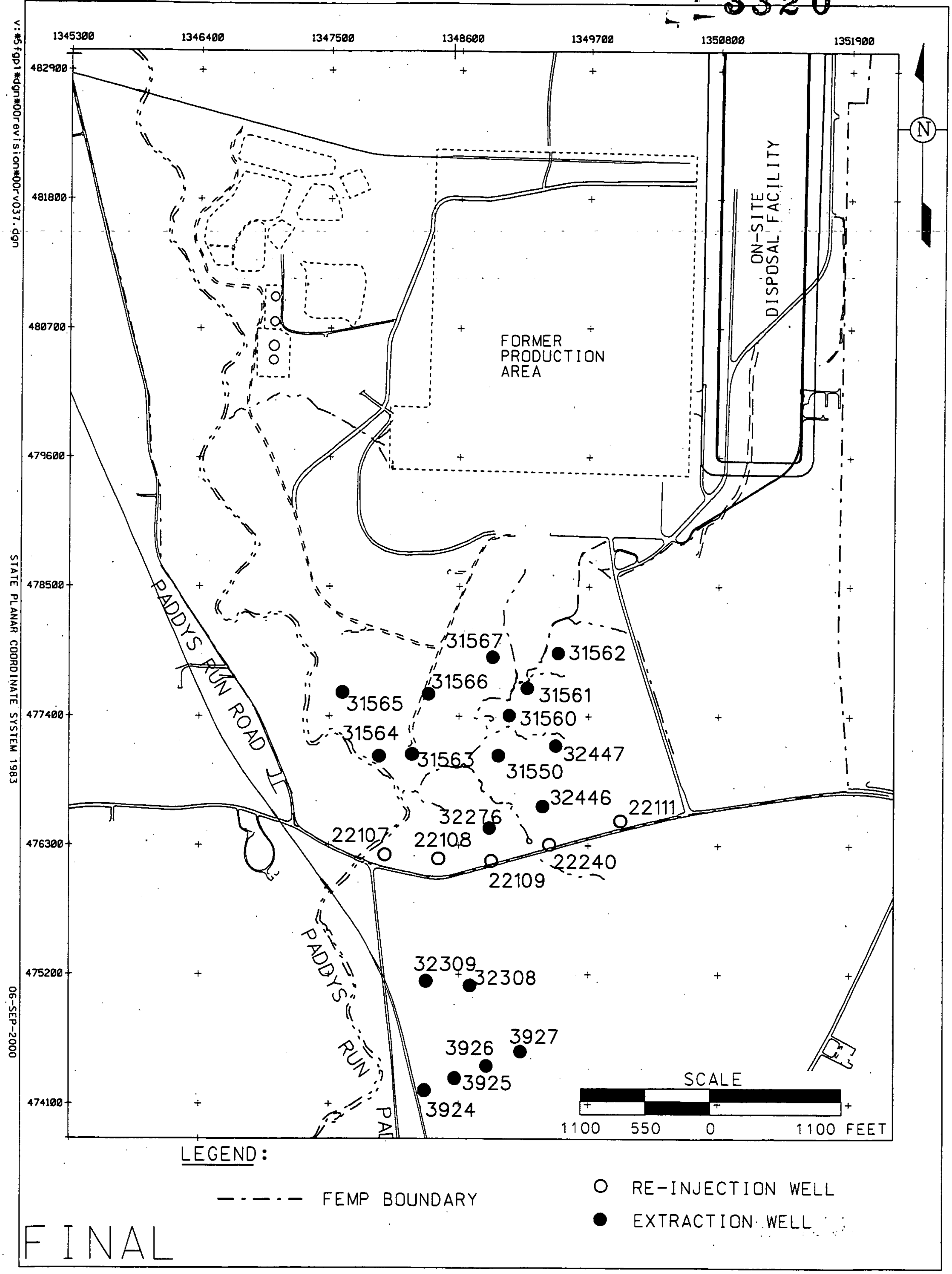

FIGURE 3-3. EXTRACTION AND RE-INJECTION WELL MONITORING LOCATIONS

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As explained below, the South Plume Module consists of six extraction wells (3924, 3925, 3926, 3927, 32308, and 32309). All six wells will be operational in 2001 and 2002. Extraction Wells 3924, 3925, 3926, and 3927, which were originally called the South Plume Module, have been in operation since 1993 as part of a removal action. Located at the southern edge of the total uranium plume, the South Plume Module, as reported in The Work Plan for the South Contaminated Plume Removal Action (DOE 1992), was originally installed to create a hydraulic barrier and to prevent the further southern migration of the uranium plume (DOE 1992). In 1998 two additional extraction wells (32308 and 32309) became operational just north of the four original South Plume Module wells. These two wells were installed under a project known as the South Plume Optimization Module. The South Plume Module will be used to refer to those original extraction wells installed under the South Plume Module and those installed under the South Plume Optimization Module.

The South Field Extraction (Phase I) Module consists of 11 operating wells (31550, 31560, 31561, 31562, 31563, 31564, 31565, 31567, 32446, 32447, and 32276). Operation of the wells (with the exception of 32446 and 32447) began in July 1998. Extraction Wells 32446 and 32447 began operating in February of 2000.

The Re-Injection Module consists of Re-Injection Wells 22107, 22108, 22109, 22111, and 22240. Operation of the re-injection wells began in September 1998 as part of a one-year technology demonstration. Following completion of the re-injection demonstration in September of 1999, it was decided to incorporate re-injection technology into the aquifer remedy.

The groundwater monitoring program described in this IEMP is designed around the modular remediation strategy presented above. For modeling and monitoring purposes, the aquifer is divided into five zones referred to as aquifer zones (Figure 3-4). These aquifer zones are used to evaluate the predicted performance (both individually and collectively) at the aquifer restoration modules. Four of the five aquifer zones (Aquifer Zones 1 through 4) contain aquifer remediation modules. Aquifer Zone 0 (the 5th zone) is the area outside the other four aquifer zones. The location of the extraction or re-injection wells comprising the restoration modules is as follows:

- The South Plume Module is located in Aquifer Zone 4.
- The South Field Extraction (Phase I and II) Modules and the Re-Injection Module are located in Aquifer Zone 2.

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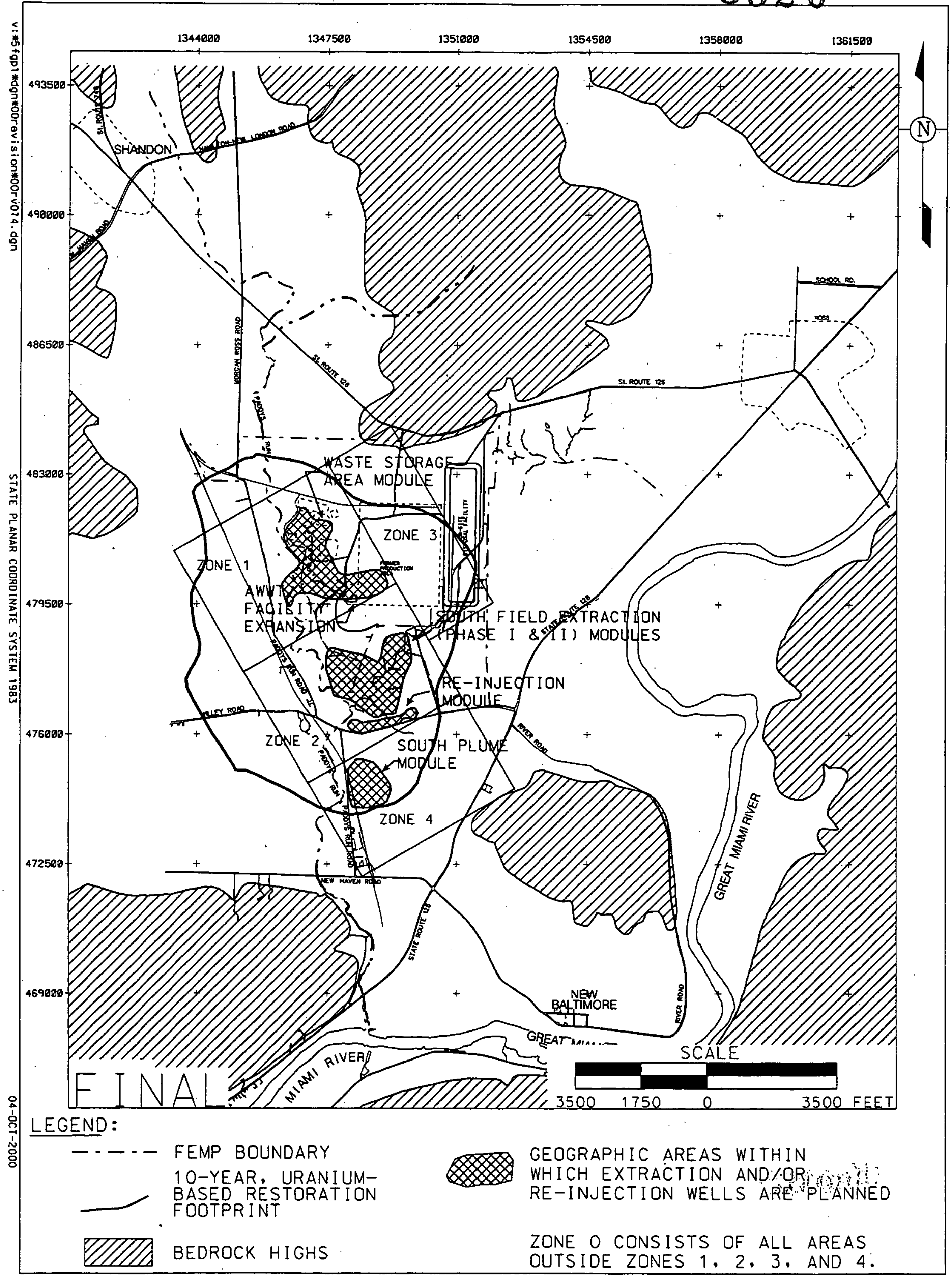

FIGURE 3-4. GROUNDWATER AQUIFER ZONES AND AQUIFER RESTORATION FOOTPRINT

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- The Waste Storage Area Module is located in Aquifer Zone 1.

The 10-year, uranium-based restoration footprint is shown in Figure 3-4 so that its relationship to the aquifer zones can be seen. As explained in Section 3.4.2.3, these aquifer zones were used to help sort and select zone-specific groundwater monitoring constituents.

3.4.2.2 Well Selection Criteria

Geologic and hydrogeologic properties, predicted groundwater flow (during remediation), and contaminant distribution within the Great Miami Aquifer, characterized in the Operable Unit 5 remedial investigation/feasibility study process, have served as input to the design of the IEMP groundwater monitoring program. Field measurements and computer simulations have been conducted to support the design efforts. All the available information was reviewed to select appropriate monitoring well locations. In general, the monitoring well locations for the IEMP were selected according to the following criteria:

- Monitor within the 10-year, uranium-based restoration footprint unless an operational concern (i.e., the close proximity of the South Plume extraction wells to the Paddys Run Road Site plume) requires a monitoring location to be outside of the capture zone

- Use existing monitoring wells and avoid installing new monitoring wells until determined necessary based on operational knowledge which will be used to help select new locations

- Provide adequate areal coverage across each remediation module area

- Include monitoring wells which are needed to meet site-specific monitoring commitments

- Avoid selecting monitoring well locations which would interfere with surface remediation activities such as soil excavations

- Select monitoring well locations that will provide data needed to determine if groundwater model predictions are being realized.

During 2001 and 2002, 120 wells at the FEMP will be monitored as identified in subsequent subsections. It is important to note that it may be necessary to plug and abandon monitoring wells to facilitate remediation activities.

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3.4.2.3 Constituent Selection Criteria

Restoration of the aquifer will be verified against FRLs. FRLs for the aquifer have been established in the Operable Unit 5 Record of Decision for 50 constituents of concern. Groundwater monitoring is focusing on these 50 FRL constituents to assess the progress of the aquifer remedy. These 50 FRL constituents have been either detected in the aquifer or have the predicted potential to reach the aquifer within 1,000 years and pose an unacceptable risk to human health and/or the environment. During the active restoration process, the FEMP is tracking the progressive success of the remedy using a logical "short list" of constituents (developed through the methodology described in Appendix A), and then verifying the completion of the remedy (stepwise for each module, as appropriate) using the full suite of 50 FRL constituents identified in the Operable Unit 5 Record of Decision. The list of constituents presented in this version of the IEMP focuses on monitoring for 2001 and 2002. It is a revised version of the list of constituents contained in the last version of the IEMP. It has been updated using analytical results for data collected in 1998 and 1999. Subsequent revisions to the IEMP are expected to focus on the monitoring activities and the constituents needed to support a collective decision on the part of DOE, EPA, and OEPA that restoration activities are complete for each module. Later revisions will also define the FEMP's long-term groundwater monitoring activities such as post-pumping rebound monitoring and certification monitoring.

The 50 FRL constituents presented in the Operable Unit 5 Record of Decision are organized into four categories for the purpose of monitoring. Specific monitoring objectives were considered in subdividing the constituents into specific groups:

- Is the success of the groundwater remedy proceeding satisfactorily at the pace that is desired?
- Are engineering adjustments to the system (e.g., flow rates, well locations, etc.) needed?
- Are FRL constituents migrating beyond the hydraulic zone of capture created by the restoration system?
- Are new FRL constituents arriving in the aquifer as a result of migration through the glacial overburden or as a result of surface water infiltration?
- Is sufficient information being gathered to ultimately demonstrate that remedial objectives contained in the Operable Unit 5 Record of Decision have been obtained?
- Have all specific regulatory-based monitoring requirements for specific constituents been satisfied in the selection process?

By categorizing the constituents, it is possible to identify a short list of indicator constituents. This short list of constituents is monitored more frequently than the other FRL constituents. The short list was established by determining the following:

- Presence in the aquifer, based on one or more FRL exceedances in the aquifer. The Operable Unit 5 remedial investigation/feasibility study data set and 1994 through 1999 groundwater data sets were evaluated.
- Presence in the glacial overburden, predicted ability to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and/or the environment based on the Feasibility Study Report for Operable Unit 5 (DOE 1995b) modeling results.

Constituents are organized into zone-specific lists based upon the monitoring objectives noted above and the geographic locations of the monitoring module/program. Appendix A provides the selection strategy, approach, and updated results. A summary is presented in Table 3-2.

The following is a description of the information contained in Table 3-2, and how the information in the table was used to determine the most appropriate constituents for a particular module/program.

- Column 1, Constituents: This column represents the suite of constituents being monitored in the groundwater modules/activities. It consists of the constituents for which a FRL was established in the Operable Unit 5 Record of Decision.
- Column 2, Groundwater FRLs: This column represents the human-health protective remediation levels for groundwater that were established in the Operable Unit 5 Record of Decision.
- Column 3, Zones with Groundwater Concentrations > FRL: This column identifies, by aquifer zone, the constituents that have been detected in the aquifer at concentrations above their established FRL. In order to determine the location of FRL exceedances in the aquifer, the analytical data were sorted into the same four zones (Aquifer Zones 1 through 4) used to model the aquifer remediation (described in Appendix F.7 of the Operable Unit 5 Feasibility Study Report). A 5th zone (Aquifer Zone 0) includes the area outside Aquifer Zones 1 through 4 (Figure 3-4).
- Column 4, Mobility/Persistence Characteristic: This column identifies which constituents failed or passed the model screening (Operable Unit 5 Feasibility Study Report, Table F.2-2). FRL constituents predicted to have the ability to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and/or the environment are identified as letter MP. Section A.4.2 contains information that clarifies the "MP" and "N" designations.

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TABLE 3-2

CATEGORIZATION OF GROUNDWATER FRL CONSTITUENTS BASED ON EXCEEDANCES, MOBILITY, AND PERSISTENCE

Constituents	Groundwater FRL[a]	Zones with Groundwater Concentrations > FRL[b]	Mobility/Persistence Characteristic[c]	Categorization by Aquifer Zone[d] Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
General Chemistry:	**mg/L**							
Fluoride	4	0,1,3	MP	≥MP	≥MP	<MP	≥MP	<MP
Nitrate	11	0,1,2,4	MP	≥MP	≥MP	≥MP	<MP	≥MP
Inorganics:	**mg/L**							
Antimony	0.0060	0,1,2,3,4	N	>N	>N	>N	>N	>N
Arsenic	0.050	0,1,2,3,4	N	>N	>N	>N	>N	>N
Barium	2.0	4	N	<N	<N	<N	<N	>N
Beryllium	0.0040	1,3,4	N	<N	>N	<N	>N	>N
Boron	0.33	2	MP	<MP	<MP	≥MP	<MP	<MP
Cadmium	0.014	0,1,2,3,4	N	>N	>N	>N	>N	>N
Cobalt	0.17	1,3,4	N	<N	>N	<N	>N	>N
Copper	1.3	-	N	<N	<N	<N	<N	<N
Lead	0.015	0,1,2,3,4	N	>N	>N	>N	>N	>N
Manganese	0.90	0,1,2,3,4	N	>N	>N	>N	>N	>N
Mercury	0.0020	0,1,2,3,4	MP	≥MP	≥MP	≥MP	≥MP	≥MP
Molybdenum	0.10	1,3	N	<N	>N	<N	>N	<N
Nickel	0.10	0,1,2,3,4	N	>N	>N	>N	>N	>N
Selenium	0.050	1,2,3,4	N	<N	>N	>N	>N	>N
Silver	0.050	0,1,4	N	>N	>N	<N	<N	>N
Vanadium	0.038	0,1,2,3,4	N	>N	>N	>N	>N	>N
Zinc	0.021	0,1,2,3,4	N	>N	>N	>N	>N	>N
Radionuclides:	**pCi/L**							
Neptunium-237	1.0	0,2,4	MP	≥MP	<MP	≥MP	<MP	≥MP
Radium-226	20	4	N	<N	<N	<N	<N	>N
Radium-228	20	-	N	<N	<N	<N	<N	<N
Strontium-90	8.0	0,1,3,4	MP	≥MP	≥MP	<MP	≥MP	≥MP
Technetium-99	94	0,1	MP	≥MP	≥MP	<MP	<MP	<MP
Thorium-228	4.0	0,1,2,3,4	N	>N	>N	>N	>N	>N
Thorium-230	15	-	N	<N	<N	<N	<N	<N
Thorium-232	1.2	0,2,4	N	>N	<N	>N	<N	>N
	µg/L							
Uranium, Total	20	0,1,2,3,4	MP	≥MP	≥MP	≥MP	≥MP	≥MP
Organics:	**mg/L**							
alpha-Chlordane	0.0020	-	MP	<MP	<MP	<MP	<MP	<MP
Aroclor-1254	0.00020	-[f]	N	<N	<N	<N	<N	<N
Benzene	0.0050	0	N	>N	<N	<N	<N	<N
bis(2-Chloroisopropyl)ether	0.0050	-[f]	N[g]	<N	<N	<N	<N	<N

TABLE 3-2
(Continued)

Constituents	Groundwater FRL[a]	Zones with Groundwater Concentrations > FRL[b]	Mobility/Persistence Characteristic[c]	Categorization by Aquifer Zone[d] Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Organics (Cont'd)								
bis(2-Ethylhexyl)phthalate[h]	0.0060	-	N	<N	<N	<N	<N	<N
Bromodichloromethane	0.10	-	MP	<MP	<MP	<MP	<MP	<MP
Bromomethane	0.0021	-	N	<N	<N	<N	<N	<N
Carbazole	0.011	-	N[g]	<N	<N	<N	<N	<N
Carbon disulfide	0.0055	0,1,2,3	N	>N	>N	>N	>N	<N
Chloroethane	0.0010	-[f]	N[h]	<N	<N	<N	<N	<N
Chloroform	0.10	-	N	<N	<N	<N	<N	<N
1,1-Dichloroethane	0.28	-	N	<N	<N	<N	<N	<N
1,1-Dichloroethene	0.0070	4	N	<N	<N	<N	<N	>N
1,2-Dichloroethane	0.0050	4	MP	<MP	<MP	<MP	<MP	>MP
Methylene chloride	0.0050	-	N	<N	<N	<N	<N	<N
4-Methylphenol	0.029	-	N	<N	<N	<N	<N	<N
4-Nitrophenol	0.32	-	N[h]	<N	<N	<N	<N	<N
Octachlorodibenzo-p-dioxin	0.00000010	-[f,i]	N	<N	<N	<N	<N	<N
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.000010	-[i]	N[h]	<N	<N	<N	<N	<N
Trichloroethene	0.0050	0,1,2,4	N	>N	>N	>N	<N	>N
Vinyl chloride	0.0020	-	MP	<MP	<MP	<MP	<MP	<MP

Note: Highlighting indicates "short list" of constituents.

[a]From Table 9-4 in Operable Unit 5 Record of Decision

[b]0, 1, 2, 3, and 4 indicate the aquifer zone(s) where constituent was detected in the aquifer above the FRL. From Operable Unit 5 remedial investigation/feasibility study data set and 1994 through 1999 groundwater data. - indicates that the constituent was not detected in the aquifer above the FRL.

[c]From Operable Unit 5 Feasibility Study Report, Table F.2-2. A constituent that failed modeling (model screening predicted that it has the ability to migrate vertically to the aquifer) is considered mobile and persistent, and is listed as MP. A constituent that passed modeling (model screening indicated that it could not reach the aquifer) is considered not mobile and persistent, and is listed as N.

[d]>MP = Has been detected in the aquifer at concentrations greater than the FRL, and has the ability to migrate vertically to the aquifer.
>N = Has been detected in the aquifer at concentrations greater than the FRL, and does not have the ability to migrate vertically to the aquifer.
<MP = Has not been detected in the aquifer at concentrations greater than the FRL, and has the ability to migrate vertically to the aquifer.
<N = Has not been detected in the aquifer at concentrations greater than the FRL, and does not have the ability to migrate vertically to the aquifer.

[e]Nitrate results have been evaluated prior to 1996. In 1996, 1997, and in future years, nitrate/nitrite results have been and will be evaluated.

[f]Analyses of constituent had method detection limit above FRL, but categorized as not having a valid FRL exceedance because model predictions indicate that it does not have the ability to migrate to the aquifer and create an unacceptable risk.

[g]Failed modeling in F.2-2. Constituent has since been remodeled with updated information and passed modeling. It was therefore assigned an N.

[h]Not in Table F.2-2. Constituent assigned an N based on literature review which shows high degradation rates for chloroethane and 4-nitrophenol and low water solubility for 2,3,7,8 tetrachlorodibenzo-p-dioxin.

[i]Categorized as not having a valid FRL exceedance because it does not have the ability to migrate to the aquifer and create an unacceptable risk.

- Columns 5-9, Categorization by Zone: These columns present a combination of the information presented in Column 3 (FRL exceedance) and Column 4 (Mobility/Persistence Characteristic). The constituents are categorized, by aquifer zone, based on the following four characteristics:

  - >MP The constituent has been detected in the aquifer at concentrations greater than its established FRL and is considered "Mobile and Persistent." It has been predicted to be able to migrate vertically from the glacial overburden to the aquifer and has already been detected at concentrations exceeding its FRL in the aquifer.

  - >N The constituent has been detected in the aquifer at concentrations greater than its established FRL but is "Not considered mobile and persistent." This constituent is not predicted to be able to migratevertically through the glacial overburden, reach the aquifer, and create an unacceptable risk. Background conditions and/or surface water infiltration through breaches in the glacial overburden may be the cause of the isolated FRL exceedances noted in the historical record.

  - <MP The constituent has not been detected in the aquifer at concentrations greater than its established FRL, but is considered both "Mobile and Persistent." This constituent is predicted to be able to migrate vertically through the glacial overburden to the aquifer (if no source actions are taken), but as yet has not been detected at concentrations exceeding its FRL in the aquifer.

  - <N The constituent has not been detected in the aquifer at concentrations greater than its established FRL and is "Not considered mobile and persistent."

A zone-specific breakdown of the number of constituents in each of the four categories is presented below:

BREAKDOWN OF FRL CATEGORY CONSTITUENTS BY AQUIFER ZONE

Constituent Category	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
>MP	7	6	5	4	6
>N	14	16	13	14	18
<MP	5	6	7	8	6
<N	23	21	24	23	19

The nine short list constituents that are categorized as ">MP" in at least one aquifer zone are:

- Fluoride
- Nitrate
- Boron
- Mercury
- Neptunium-237
- Strontium-90
- Technetium-99
- Uranium, Total
- 1,2-Dichloroethane.

These constituents are considered to be the master short list of indicator constituents from which zone-specific short lists were developed. These short list constituents will be monitored more frequently than the other constituents in order to track the progress of the remedy. These constituents have been detected in the aquifer at concentrations above their established FRLs and they are both mobile and persistent.

Each of the four categories of constituents will be targeted for monitoring at the following frequency:

- >MP Constituents are to be monitored quarterly in source areas and at the property boundaries because they have been detected in the Great Miami Aquifer above their established FRL and are considered mobile and persistent.
- >N Constituents are to be monitored annually in source areas because they have been detected in the Great Miami Aquifer above their established FRLs and because they are not considered mobile and persistent. Constituents are to be monitored quarterly at the property boundaries so that sufficient data will be available to evaluate water quality trends.
- <MP Constituents are to be monitored annually because they have not been detected in the Great Miami Aquifer above their established FRL and because they are considered mobile and persistent.
- <N Constituents are to be monitored every five years to verify that these lowest-priority FRL constituents remain below their established FRL. The first sampling is scheduled for 2001.

Exception:

- The constituents with the >MP characteristic in the Plant 6 area will be monitored semiannually instead of quarterly because no active restoration module is currently planned for this area.
- The list of constituents for monitoring was developed using Columns 5 through 9 of Table 3-2. These lists can be found in Sections 3.5.1 and 3.5.2 of the IEMP. Columns 5 through 9 indicate how constituents have been categorized for each aquifer zone. The assignment of aquifer zones for monitoring FRL constituents is as follows:
  - South Plume Module is monitored in Aquifer Zones 2 and 4.
  - South Field Module is monitored in Aquifer Zone 2.
  - The Re-Injection Module is monitored in Aquifer Zone 2.
  - Waste Storage Area Module is monitored in Aquifer Zone 1.
  - Plant 6 area is monitored in Aquifer Zone 3.
  - Property Boundary Monitoring wells monitor downgradient of Aquifer Zones 0 through 3.

Exceptions:

- Private wells and Paddys Run Road Site monitoring wells have established lists that were put together to meet specific objectives.

In addition to the analytical constituents, several field parameters will be monitored during each groundwater sample collection event. These field parameters include dissolved oxygen, pH, specific conductance, temperature, and turbidity. They serve as indicators of aquifer conditions and are used to verify that groundwater samples are representative.

Groundwater monitoring for the IEMP will continue in 2001 and 2002 with all constituents characterized as >MP, >N, and <MP being sampled. The <N constituents are analyzed once every five years, and will be analyzed for the first time in 2001. Each year the monitoring lists will be re-evaluated using the same logic previously outlined in this section. The new data collected may indicate that it is necessary to increase or decrease the monitoring frequency for some constituents. Appendix A outlines the criteria which will be used to change sampling frequencies.

3.5 DESIGN OF THE IEMP GROUNDWATER MONITORING PROGRAM

Groundwater monitoring to assess performance of the aquifer remedy and aquifer conditions is organized around the individual restoration modules that will be used to implement the aquifer remedy.

- The South Plume Module (Section 3.5.1.1)
- The South Field Extraction (Phase I and II) Modules (Section 3.5.1.2)
- The Re-Injection Module (Section 3.5.1.3)
- The Waste Storage Area Module (Section 3.5.1.4)
- The Plant 6 area (aquifer condition monitoring only) (Section 3.5.1.5).

Monitoring in 2001 and 2002 will be a continuation of the strategy used from 1997 through 2000. Monitoring will be conducted by separately monitoring the operational performance of each individual remediation module and by combining aquifer data collected from individual modules to assess aquifer conditions.

The strategy and technical approach will be expanded in subsequent revisions to the IEMP to encompass each of the new groundwater extraction and re-injection modules that will be brought on line over the life of the remedy.

Water levels will be measured in all of the module areas (Section 3.5.1.6) to assess how the individual modules interact with one another to capture contaminants in the aquifer.

Groundwater monitoring to meet other site commitments or needs are described in Section 3.5.2:

- Private Well Monitoring, Section 3.5.2.1
- Property Boundary Monitoring, Section 3.5.2.2.

A start-up monitoring project-specific plan will be developed to supplement the IEMP each time a new module begins operations.

3.5.1 Groundwater Restoration Module Monitoring for 2001 and 2002

During 2001 and 2002 the South Plume extraction wells, the South Field (Phase I) extraction wells, and the re-injection wells will be operating. Groundwater monitoring for remedy performance during 2001 and 2002 will focus on tracking the progress of these modules.

3.5.1.1 South Plume Module

The South Plume Module is located in Aquifer Zone 4 (Figure 3-4). Aquifer Zone 4 is located mostly south of FEMP property. Pumping from this module will also affect the southern portion of Aquifer Zone 2. The aquifer in this area is contaminated with a uranium plume that resulted from infiltration through Paddys Run where contaminants were carried southward and eastward into the aquifer (Figure 3-2). Remediating this off-property uranium plume and preventing it from mixing with a separate non-FEMP plume, located further to the south (Paddys Run Road Site plume), is a high priority of the Aquifer Restoration and Wastewater Project. As explained in Section 3.3, an administrative boundary has been established between the FEMP and Paddys Run Road Site contaminant plumes. Groundwater monitoring to assess the area south of the FEMP administrative boundary, and to determine the impact that pumping from the South Plume extraction wells has on the Paddys Run Road Site plume, will continue until the need for action is established and implemented.

In 1997 and half of 1998, only four extraction wells were operating (3924, 3925, 3926, and 3927); referred to as the South Plume Module. In 1998 Extraction Wells 32308 and 32309 began operating just north of the original South Plume Module wells. These two wells were installed under a project known as the South Plume Optimization Module. During 2001 and 2002 all six wells will be operating.

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Three South Plume Module groundwater monitoring activities will be conducted in 2001 and 2002 to:

- Document the effectiveness of the pumping in maintaining a hydraulic barrier that limits the further southern migration of the total uranium plume and document the area of uranium contamination (above 20 µg/L) south of the administrative boundary (Activity 1)
- Document how other FRL constituent concentrations within the total uranium plume are being reduced by the pumping effort. The concentrations of other FRL constituents in the uranium plume north of the administrative boundary (defined in Section 3.3) are monitored under the South Plume Module (Activity 2)
- Document the degree to which the Paddys Run Road Site plume is being affected by the operation of the South Plume Module (Activity 3).

Forty-two monitoring wells will be monitored. Data collected from many of the wells will be used to address more than one South Plume Module monitoring activity. The wells that will be monitored, frequency of sampling, and the corresponding activity for which the monitoring is being conducted are presented in Table 3-3. The three South Plume Module monitoring activities are discussed below.

Activity 1

Forty wells will be analyzed quarterly for total uranium to document uranium concentrations in the South Plume area. Although not included in the routine quarterly program, Monitoring Wells 2880 and 3880 will be sampled once a year for total uranium. Fifteen fewer wells will be monitored quarterly in 2001 and 2002 than were monitored in 1999 and 2000. Monitoring Wells 2551 and 3551 were plugged and abandoned and Monitoring Well 2546 was removed from the sampling activity due to a turbidity issue with the well. Monitoring Well 2546 is not owned by the FEMP, and was not installed or developed to FEMP standards, however, water level monitoring at this well will continue. Quarterly monitoring at Monitoring Wells 2880 and 3880 was replaced by quarterly monitoring at Well 6880. Annual monitoring for uranium will still occur at Monitoring Wells 2880 and 3880. Monitoring Wells 2881 and 3881 were replaced by Monitoring Well 6881. As explained in a transmittal of Proposed Changes Resulting from the Annual Review of the IEMP, dated October 29, 1999, monitoring wells 2060, 2434, 2544, and 21194 have been removed from the monitoring activity. The screens in these four wells are no longer positioned at the correct depth to properly monitor the uranium plume. Extraction wells 3924, 3925, 3926, 3927, 32308, and 32309 were removed to avoid duplication of efforts with wellfield operation monitoring. Combined with water elevation data, the total uranium concentration data will be used to document:

- The effectiveness of the pumping in the South Plume Module in maintaining a hydraulic barrier that limits the further southern migration of the total uranium plume
- Uranium concentration south of the administrative boundary
- Uranium concentrations in the South Plume south of Willey Road
- Uranium concentrations just north of Willey Road.

TABLE 3-3

SOUTH PLUME MODULE

		Sampling Frequency		
		Monitor Uranium across Module Area	Monitor other Target FRL Constituents across Module Area[a]	Monitor PRRS Constituents
Well No.	Well ID	Activity 1	Activity 2	Activity 3
1	2002	Quarterly		
2	2015	Quarterly		
3	2017	Quarterly		
4	2093	Quarterly	Quarterly	
5	2095	Quarterly	Quarterly	
6	2106[b]	Quarterly		
7	2125	Quarterly	Quarterly	
8	2128	Quarterly		Quarterly
9	2166	Quarterly		
10	2396	Quarterly		
11	2398[b]	Quarterly		
12	2545	Quarterly		
13	2550	Quarterly		
14	2552	Quarterly	Quarterly	
15	2553	Quarterly		
16	2625	Quarterly		Quarterly
17	2636	Quarterly		Quarterly
18	2897	Quarterly	Quarterly	
19	2898	Quarterly	Quarterly	Quarterly
20	2899	Quarterly	Quarterly	Quarterly
21	2900	Quarterly	Quarterly	Quarterly
22	3015	Quarterly		
23	3069[b]	Quarterly		
24	3093	Quarterly	Quarterly	
25	3095	Quarterly	Quarterly	
26	3106[b]	Quarterly		
27	3125	Quarterly	Quarterly	
28	3128	Quarterly		Quarterly
29	3396	Quarterly		
30	3550	Quarterly		
31	3552	Quarterly	Quarterly	
32	3636	Quarterly		Quarterly
33	3897	Quarterly	Quarterly	
34	3898	Quarterly	Quarterly	Quarterly
35	3899	Quarterly	Quarterly	Quarterly
36	3900	Quarterly	Quarterly	Quarterly
37	4125	Quarterly		
38	21063	Quarterly	Quarterly	
39	6880	Quarterly	Quarterly	
40	6881	Quarterly	Quarterly	
41	2880	Annual		
42	3880	Annual		

[a]While samples are collected quarterly, some constituents are only analyzed annually, per the list of constituents that will be analyzed in the South Plume monitoring wells for Activity 2.
[b]These wells are sampled as property boundary wells. The data are also used for the South Plume Module.

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Table 3-3 includes a list of the wells that will be sampled under Activity 1. Figure 3-5 also shows the locations of these monitoring wells.

Activity 2

Nineteen wells will be sampled for other FRL constituents to document how the other FRL constituent concentrations are being reduced by the pumping effort. Four fewer wells will be monitored in 2001 and 2002 than were monitored in 1999 and 2000. Monitoring Wells 2881 and 3881 were replaced with Monitoring Well 6881. Monitoring Wells 2880 and 3880 were replaced with Monitoring Well 6880. Monitoring Wells 2551 and 3551 were plugged and abandoned. A list of the 29 constituents that will be sampled for is provided below. Table 3-3 provides a list of the wells that will be sampled under Activity 2. Figure 3-6 depicts the locations of the wells. The 29 constituents (listed below) are those which have been categorized as >MP, <MP, or >N in Aquifer Zone 4.

Section 3.4.2.3 and Appendix A provide additional information on the selection process. The five >MP constituents will be analyzed quarterly and the 18 >N, and six <MP constituents will be analyzed annually. In 2001 the <N constituents will be analyzed once. The <N constituents are listed separately below.

LIST OF CONSTITUENTS THAT WILL BE ANALYZED IN THE SOUTH PLUME MONITORING WELLS FOR ACTIVITY 2

Constituents Categorized as ">MP" Shown in **Bold** are Analyzed Quarterly
All <MP and >N Constituents are Analyzed Annually

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	**Neptunium-237**	alpha-Chlordane
Nitrate/Nitrite	Arsenic	Radium-226	Bromodichloromethane
	Barium	**Strontium-90**	1,1-Dichloroethene
	Beryllium	Technetium-99	**1,2-Dichloroethane**
	Boron	Thorium-228	Trichloroethene
	Cadmium	Thorium-232	Vinyl chloride
	Cobalt		
	Lead		
	Manganese		
	Mercury		
	Nickel		
	Selenium		
	Silver		
	Vanadium		
	Zinc		

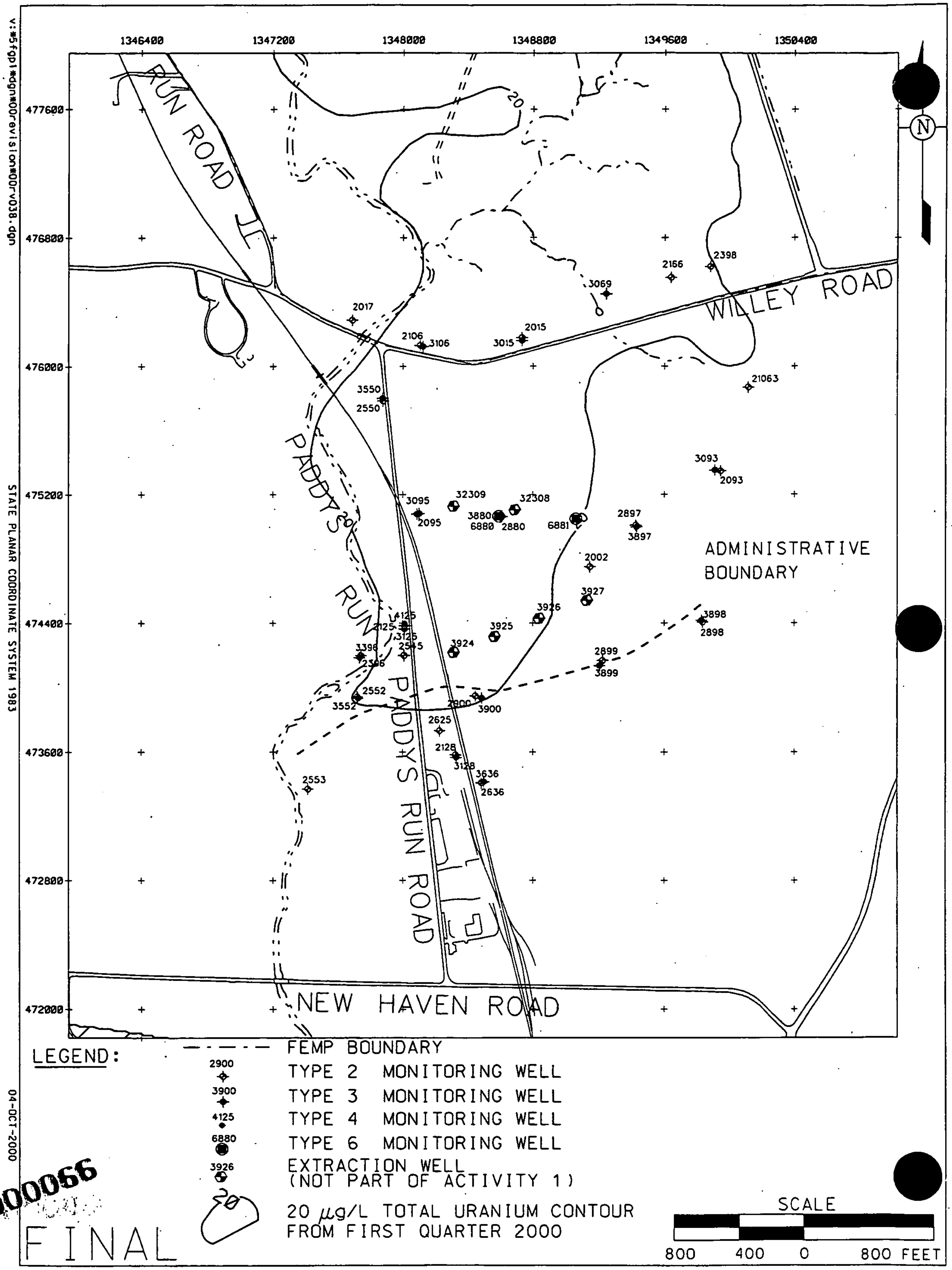

FIGURE 3-5. SOUTH PLUME MODULE MONITORING WELLS, ACTIVITY 1

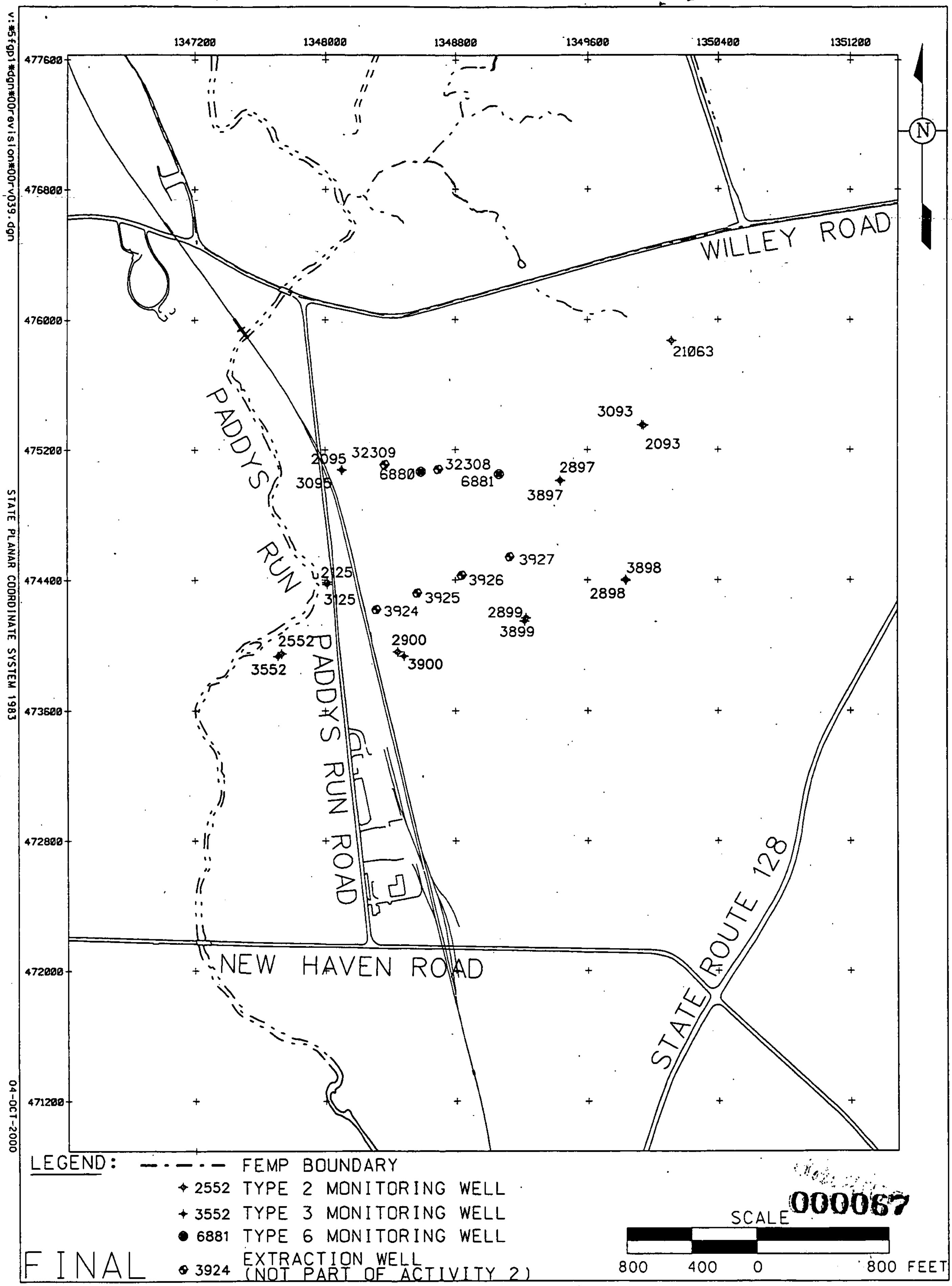

FIGURE 3-6. SOUTH PLUME MODULE MONITORING WELLS, ACTIVITY 2

LIST OF "<N" CONSTITUENTS THAT WILL BE ANALYZED IN 2001 IN THE SOUTH PLUME MONITORING WELLS FOR ACTIVITY 2

All <N Constituents are Analyzed Once Every Five Years

Inorganic	Radionuclide	Organic
Copper	Radium-228	Aroclor-1254
Molybdenum	Thorium-230	Benzene
		bis(2-Chloroisopropyl)ether
		bis(2-Ethylhexyl)phthalate
		Bromomethane
		Carbazole
		Carbon disulfide
		Chloroethane
		Chloroform
		1,1-Dichloroethane
		Methylene chloride
		4-Methylphenol
		4-Nitrophenol
		Octachlorodibenzo-p-dioxin
		2,3,7,8-Tetrachlorodibenzo-p-dioxin

The well locations shown in Figure 3-6 were selected to provide good areal coverage around the South Plume extraction wells. These locations provide a line of monitoring wells north and south of Extraction Wells 3924, 3925, 3926, and 3927, and south of Extraction Wells 32308 and 32309. Monitoring of Property Boundary wells will provide data on non-FRL constituents along Willey Road, north of Extraction Wells 32308 and 32309. The Property Boundary Program is presented in Section 3.5.2.2. The intent of this monitoring is to determine the effect the pumping is having on these constituents, and to better define which of the constituents need to be monitored for the duration of the aquifer restoration.

Activity 3

The South Plume Module pumps groundwater from the aquifer immediately north of the Paddys Run Road Site; it remains important to document the influence, or lack thereof, that the pumping is having on the Paddys Run Road Site plume. In 2001 and 2002 groundwater samples will be collected quarterly from 11 monitoring wells and analyzed for Paddys Run Road Site constituents.

If pumping rates of wells in the South Plume Module are increased above rates established in 1998, then arsenic sampling will be conducted weekly in Monitoring Wells 2128, 2625, 2636, 2900, 3924, and 3925 to determine if the increased pumping rates have adversely impacted the Paddys Run Road Site plume. The weekly sampling will be done for a minimum of three weeks after a pumping rate increase and if no changes in arsenic concentration trends are observed, the increased arsenic sampling will be discontinued. The 11 wells that will be sampled quarterly in 2001 and 2002 are listed in Table 3-3 under Activity 3. Figure 3-7 identifies the locations of these monitoring wells. The Paddys Run Road Site constituent list used in 1999 and 2000 will be carried over into 2000 and 2001. The constituent list presented below represents Paddys Run Road Site constituents to be monitored.

LIST OF PADDYS RUN ROAD SITE CONSTITUENTS THAT WILL BE ANALYZED FOR ACTIVITY 3
All Constituents Analyzed Quarterly

General Chemistry	Inorganics	Organics
Phosphorus	Arsenic	Benzene
	Potassium	Ethyl benzene
	Sodium	Isopropyl benzene
		Toluene
		Total xylene

3.5.1.2 South Field Extraction Module

The South Field Extraction Module is located in Aquifer Zone 2 (Figure 3-4). The aquifer in this area is contaminated with a uranium plume which resulted from infiltration of contamination through the South Field inactive flyash pile, Paddys Run, and the Storm Sewer Outfall Ditch (Figure 3-2). The sources of contamination in the glacial overburden and wastes within the South Field inactive and active flyash piles in this area are being remediated through the Soil and Disposal Facility Project.

Restoration of the aquifer in this area began in 1998, when 10 extraction wells (31550, 31560, 31561, 31562, 31563, 31564, 31565, 31566, 31567, and 32276) began pumping around the excavation area near the Storm Sewer Outfall Ditch (South Field Extraction [Phase I] Module). Extraction Well 31566 is no longer operating. It was shut down to minimize the potential for pulling contamination into a region of the aquifer with finer grain sediment. The module was expanded in 1999 with the addition of Extraction Wells 32446 and 32447 which began operating in 2000. Figure 3-8 shows the location of the extraction wells.

Groundwater monitoring during 2001 and 2002 will be conducted to assess aquifer conditions by documenting how both uranium and non-uranium FRL constituent concentrations within the total uranium plume are being reduced by the pumping effort.

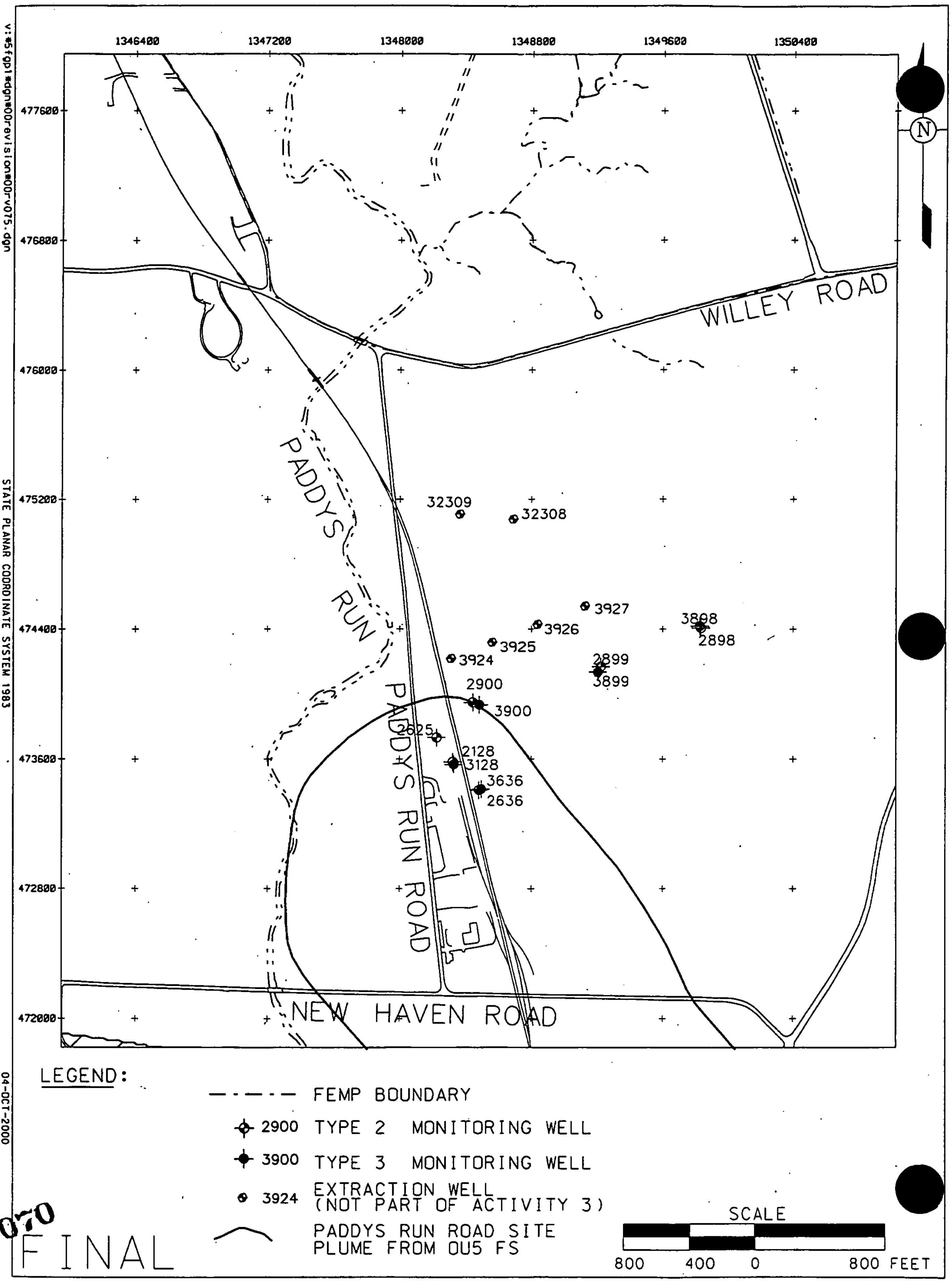

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FIGURE 3-7. SOUTH PLUME MODULE MONITORING WELLS, ACTIVITY 3

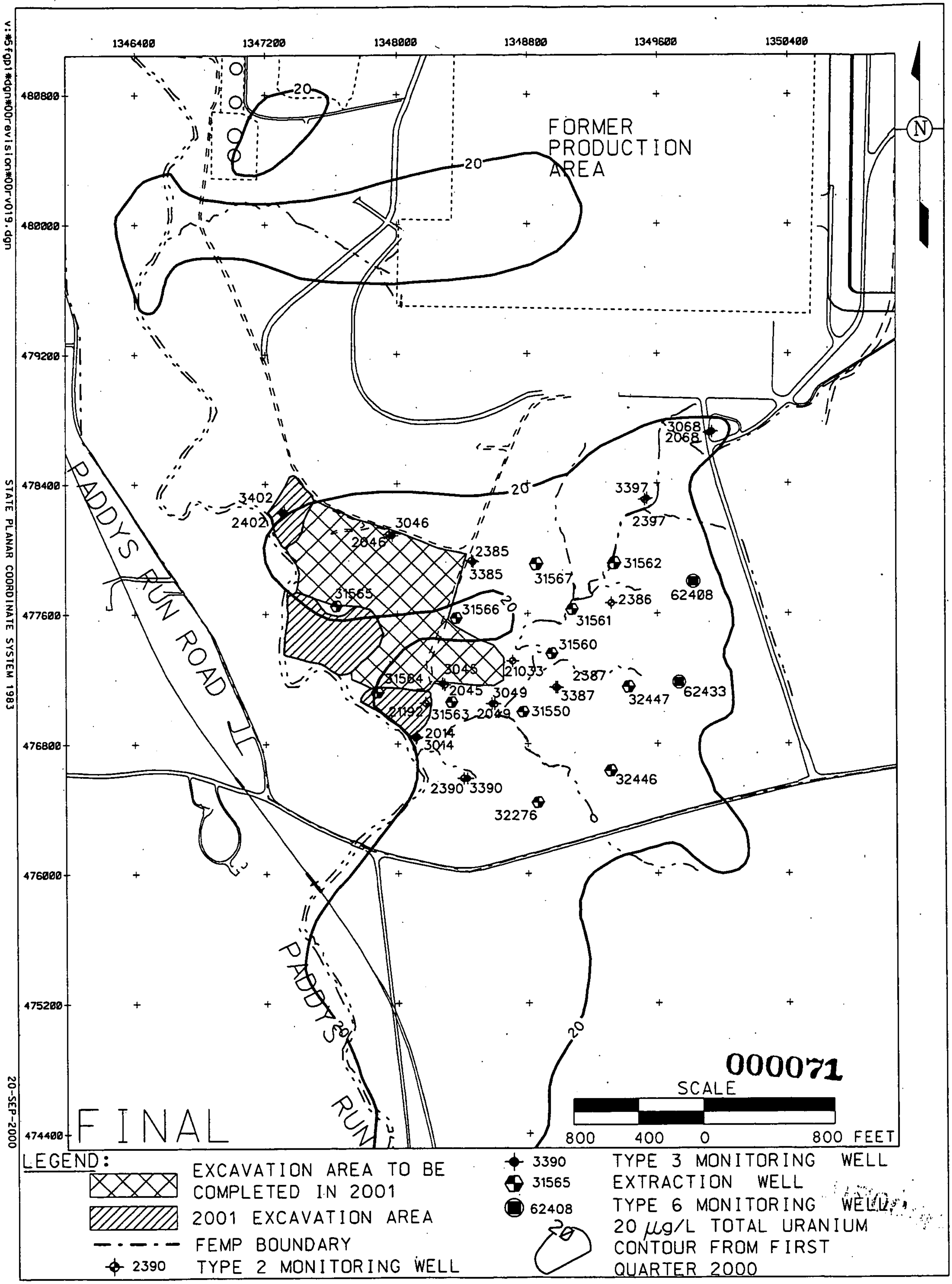

FIGURE 3-8. SOUTH FIELD EXTRACTION MODULE MONITORING WELLS

During 2001 and 2002 monitoring will take place quarterly in 25 monitoring wells. The 25 wells are listed below and shown in Figure 3-8. Monitoring Wells 62408 and 62433 were installed in 1999.

LIST OF SOUTH FIELD EXTRACTION MONITORING WELLS

2014	2045	2046	2049	2068	2385	2386	2387
2390	2397	2402	3014	3045	3046	3049	3068
3385	3387	3390	3397	3402	21033	21192	62408
62433							

These monitoring wells are located along the Storm Sewer Outfall Ditch; a few of the wells are located along the northern edge of the southern waste unit excavation area. Aquifer data from these wells, supplemented with aquifer data collected from the Property Boundary wells (Section 3.5.2.2) and the South Plume wells (Section 3.5.1.1), will provide for an integrated assessment of aquifer conditions across the South Field and South Plume areas. All 25 wells are located outside or very close to the edge of the surface excavation area. Surface excavation activities will be ongoing in 2001. Figure 3-8 depicts the planned excavation areas for 2001. Once surface wastes are removed, it is anticipated that additional extraction and monitoring wells will need to be installed. The number and location of additional wells will be described in the South Field Phase II design documentation that will be submitted to EPA and OEPA for approval before the wells are installed.

Groundwater monitoring will focus on FRL constituents that have been detected in Aquifer Zone 2 of the Great Miami Aquifer at concentrations above the established FRL, and FRL constituents that are predicted to migrate from the glacial overburden to the aquifer due to their mobility and persistence (Table 3-2). Section 3.4.2.3 and Appendix A provide additional information on the selection process. Groundwater samples will be collected quarterly and analyzed for the five constituents categorized as >MP in Aquifer Zone 2 (Table 3-2). These constituents have been detected in the Great Miami Aquifer at concentrations above the FRL and are mobile and persistent. The five constituents are bolded in the list below. A quarterly sampling frequency was selected so that seasonal concentration changes could be monitored. In addition to the quarterly sampling, groundwater samples will be collected annually and analyzed for the 13 constituents categorized as >N and the seven constituents categorized as <MP in

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Aquifer Zone 2. A yearly sampling frequency was selected for these constituents because they are less mobile (>N) or not currently present in the aquifer (<MP) above their FRL. The <N constituents will be analyzed once during 2001. The <N constituents are listed separately below.

LIST OF CONSTITUENTS WHICH WILL BE ANALYZED IN THE SOUTH FIELD MONITORING WELLS

Constituents Categorized as ">MP" Shown in **Bold** are Analyzed Quarterly
All <MP and >N Constituents are Analyzed Annually

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	**Neptunium-237**	alpha-Chlordane
Nitrate/Nitrite	Arsenic	Strontium-90	Bromodichloromethane
	Boron	Technetium-99	Carbon disulfide
	Cadmium	Thorium-228	1,2-Dichloroethane
	Lead	Thorium-232	Trichloroethene
	Manganese	**Uranium, Total**	Vinyl chloride
	Mercury		
	Nickel		
	Selenium		
	Vanadium		
	Zinc		

LIST OF "<N" CONSTITUENTS WHICH WILL BE ANALYZED IN 2001 IN THE SOUTH FIELD MONITORING WELLS

All <N Constituents are Analyzed Once Every Five Years

Inorganic	Radionuclide	Organic
Barium	Radium-226	aroclor-1254
Beryllium	Radium-228	Benzene
Cobalt	Thorium-230	bis(2-Chloroisopropyl)ether
Copper		bis(2-Ethylhexyl)phthalate
Molybdenum		Bromomethane
Silver		Carbazole
		Chloroethane
		Chloroform
		1,1-Dichloroethane
		1,1-Dichloroethene
		Methylene chloride
		4-Methylphenol
		4-Nitrophenol
		Octachlorodibenzo-p-dioxin
		2,3,7,8-Tetrachlorodibenzo-p-dioxin

3.5.1.3 Re-Injection Module

The Re-Injection Module consists of five re-injection wells located along the southern FEMP property boundary, just north of Willey Road. On September 2, 1999, DOE completed one year of active groundwater re-injection as part of a field-scale demonstration. A report detailing the demonstration was issued to EPA and OEPA on May 30, 2000. Based on the results of the demonstration, re-injection will continue at the FEMP.

Monitoring during 2001 and 2002 will be conducted to:

- Assess operation of the re-injection wells by documenting re-injection rates, gallons of water re-injected and total uranium re-injected
- Assess aquifer conditions by measuring specific conductivity, pH, Eh, and dissolved oxygen using downhole water quality probes, and by direct push sampling for uranium in the re-injection area.

As recommended in the Re-Injection Demonstration Test Report for the Aquifer Restoration and Wastewater Project (DOE 2000b) the monthly in-situ monitoring of Eh and pH conditions in the aquifer which was conducted during the demonstration will continue on a quarterly basis. Hydrolab™ downhole water quality probes and data loggers will be used to monitor specific conductivity, temperature, pH, Eh, and dissolved oxygen in the aquifer in the area where re-injection is occurring. Twenty-four hours worth of hourly readings will be collected each quarter at Monitoring Wells 22299, 22300, 22301, 22302, 22303, 32304, 32305, 32306, and 32307. Figure 3-9 depicts the locations of these monitoring wells.

As also recommended in the Re-Injection Demonstration Test Report, annual direct push sampling for total uranium will be conducted along and south of Willey Road to track progress of the re-injection over time. At each direct push location, a groundwater sample will be collected at the water table and at 10-foot intervals beneath the water table until it can be verified that the entire vertical thickness of the 20 μg/L total uranium plume has been sampled. Sampling will take place at the same seven locations that were sampled during the demonstration. Figure 3-9 shows these locations. Efforts will also be made to expand the number of locations to provide additional information on sweeping patterns, both north and south of the re-injection wells. Locations south of the demonstration sample locations would be located on private property. Access to additional southern locations would be pending landowner approval. Direct push activities will be controlled through a Project Specific Plan separate from the IEMP.

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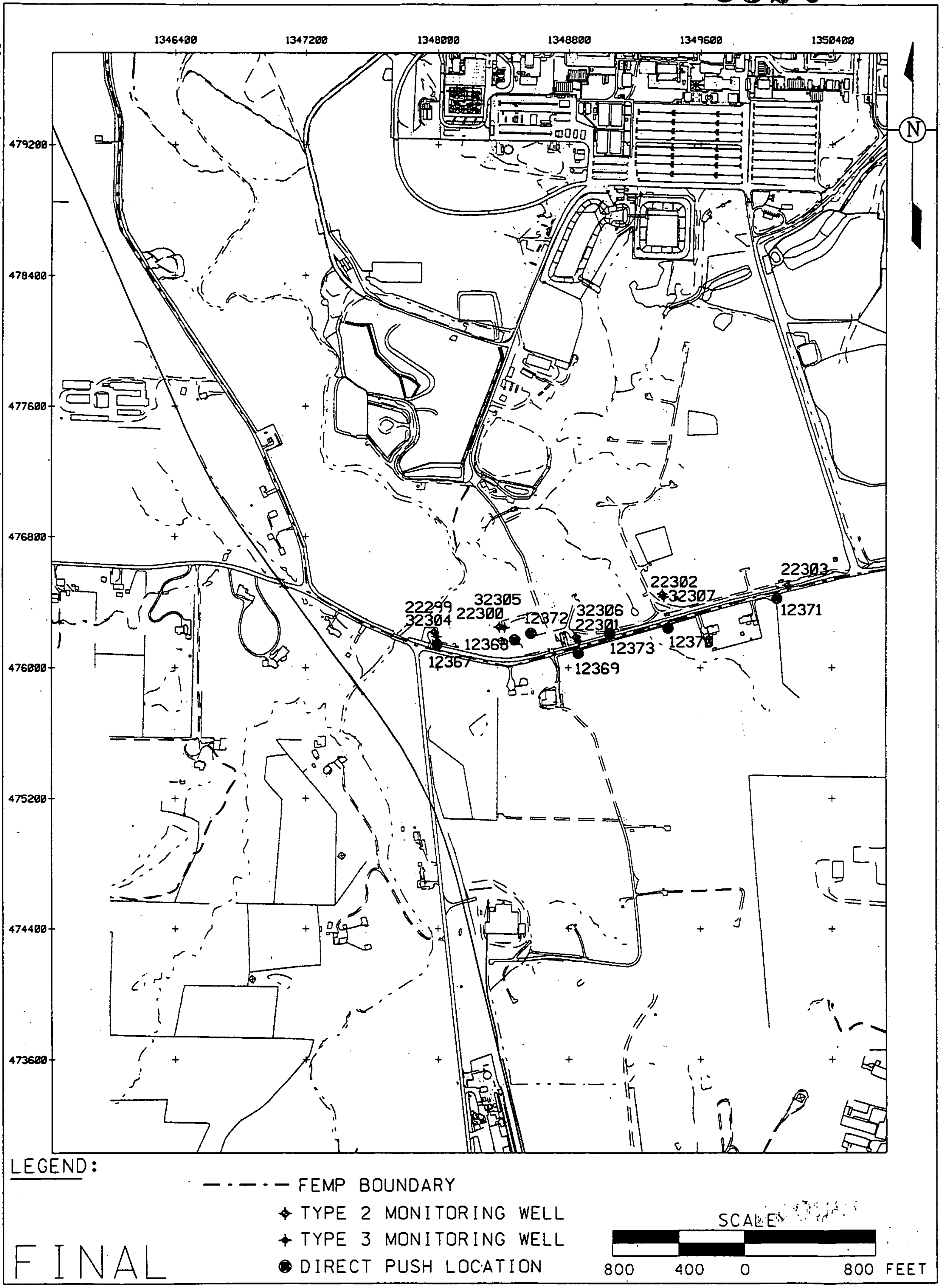

FIGURE 3-9. RE-INJECTION MODULE MONITORING WELLS AND DIRECT PUSH SAMPLING LOCATIONS

3.5.1.4 Waste Storage Area Module

As a result of a Conceptual Design Groundwater Characterization conducted in the waste storage and Plant 6 areas in late 1999 and early 2000, the one plume interpretation for the waste storage area (illustrated in the IEMP, Revision 1) (DOE 1999) has been superseded by a three-plume interpretation.. The Waste Storage Area Module is located in Aquifer Zone 1 (Figure 3-4) and contains three total uranium plumes that have been targeted for restoration (Figure 3-2). The Waste Storage Area Module is not scheduled to be operational in 2001 or 2002. The installation of the pumping system will begin after the sources, which rest above the aquifer, have been remediated. It is possible that an early remediation start could be initiated in the southern most plume that is located near the Pilot Plant Drainage Ditch. An early start remediation would consist of one or two pumping wells. Until pumping actually begins in the Waste Storage Area, water quality conditions will be monitored in existing wells to document water quality changes that may be occurring in the aquifer that could impact the design and installation of the restoration module. Prior to the construction of the Waste Storage Area Module, additional monitoring of the aquifer will be conducted to support the construction effort. This additional monitoring will be conducted through a Project Specific Plan separate from the IEMP. In the waste storage area, groundwater samples will be collected in 2001 and 2002 from 12 locations along the downgradient edge of the waste pit excavation area and the 20 μg/L total uranium plume. Three monitoring wells that were sampled in 1999 and 2000 were plugged and abandoned to make way for silo remediation activities; these were Monitoring Wells 2033, 2034, and 3034. Monitoring Well 2010 was added to the activity to improve monitoring coverage east of the waste storage area. Monitoring locations for 2001 and 2002 are listed below and shown in Figure 3-10.

LIST OF WASTE STORAGE AREA MONITORING WELLS

2008	2009	2010	2027	2032	2648
2649	2821	3009	3027	3032	3821

Monitoring Wells 2008, 2027, 2648, 2821, 3027, and 3821 are positioned downgradient from various portions of the waste storage area. Monitoring Wells 2032 and 3032 were selected because they are close to the Operable Unit 4 area. Finally, Monitoring Wells 2009 and 3009 were selected because they are located in the southern tip of the >20 μg/L total uranium plume that is present in the waste storage area. Water samples will be collected quarterly from the 12 locations and analyzed for the six constituents which have been characterized as >MP in this area (Aquifer Zone 1). In addition, samples will be collected annually from the 12 locations and analyzed for the 16 constituents characterized as >N and the six constituents categorized as <MP in Aquifer Zone 1 (Table 3-2). Section 3.4.2.3 and

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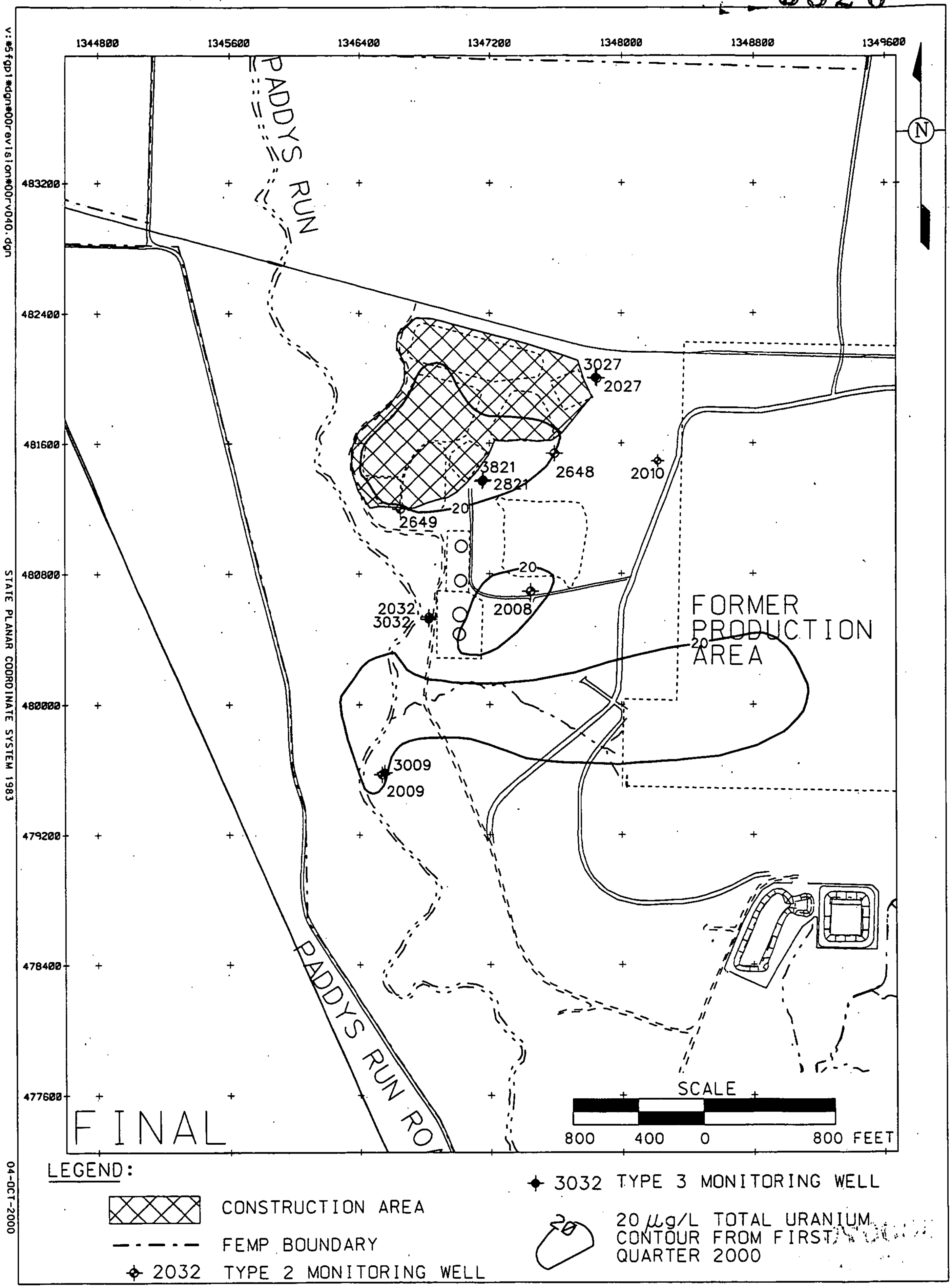


FIGURE 3-10. WASTE STORAGE AREA MODULE MONITORING WELLS

Appendix A provide additional information on the selection process. The <N constituents will also be analyzed once in 2001. The 28 constituents to be monitored in this area are listed below. The <N constituents that will be monitored for once in 2001 are listed below separately.

**LIST OF CONSTITUENTS WHICH WILL BE ANALYZED
IN THE WASTE STORAGE AREA MONITORING WELLS**

Constituents Categorized as ">MP" shown in **Bold** are Analyzed Quarterly
All <MP and >N Constituents are Analyzed Annually

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	Neptunium-237	alpha-Chlordane
Nitrate/Nitrite	Arsenic	**Strontium-90**	Bromodichloromethane
	Beryllium	**Technetium-99**	Carbon disulfide
	Boron	Thorium-228	1,2-Dichloroethane
	Cadmium	**Uranium, Total**	Trichloroethene
	Cobalt		Vinyl chloride
	Lead		
	Manganese		
	Mercury		
	Molybdenum		
	Nickel		
	Selenium		
	Silver		
	Vanadium		
	Zinc		

**LIST OF "<N" CONSTITUENTS WHICH WILL BE SAMPLED IN 2001
IN THE WASTE STORAGE AREA MONITORING WELLS**

All <N Constituents are Analyzed Once Every Five Years

Inorganic	Radionuclide	Organic
Barium	Radium-226	aroclor-1254
Copper	Radium-228	Benzene
	Thorium-230	bis(2-Chloroisopropyl)ether
	Thorium-232	bis(2-Ethylhexyl)phthalate
		Bromomethane
		Carbazole
		Chloroethane
		Chloroform
		1,1-Dichloroethane
		1,1-Dichloroethene
		Methylene chloride
		4-Methylphenol
		4-Nitrophenol
		Octachlorodibenzo-p-dioxin
		2,3,7,8-Tetrachlorodibenzo-p-dioxin

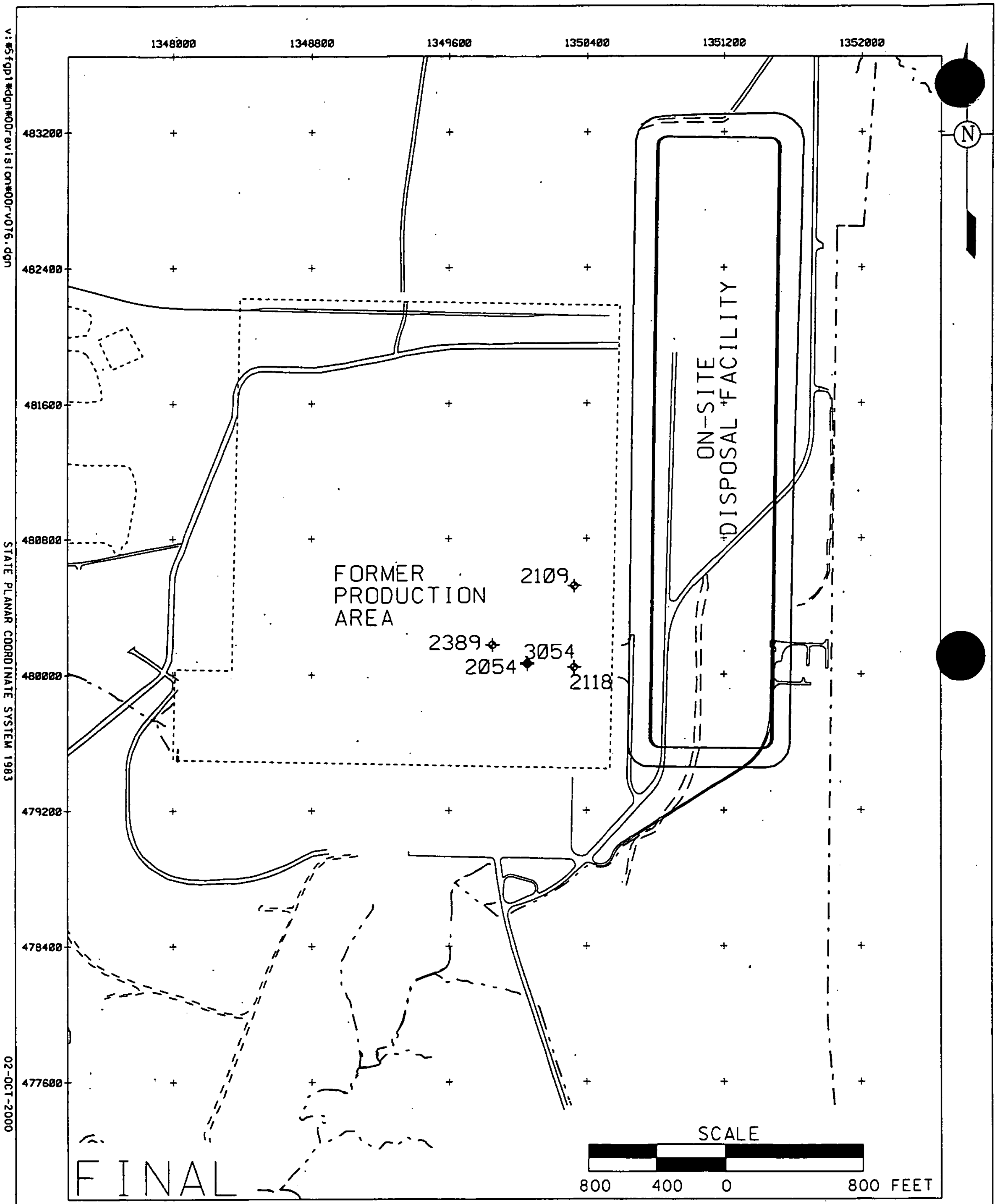
3.5.1.5 Plant 6 Area

During the Conceptual Design Groundwater Characterization conducted in the waste storage and Plant 6 areas in late 1999 and early 2000, a greater than 20 μg/L total uranium plume in the Plant 6 area was not detected. It is believed that the plume has dissipated to concentrations that are below 20 μg/L. The Plant 6 area is located in Aquifer Zone 3 (Figure 3-4). Because a uranium plume with concentrations above 20 μg/L is no longer present in this area, a restoration module for the area is no longer planned. However, groundwater sampling in the area will continue in 2001 and 2002. Water samples will be collected from five monitoring wells that encircle the area where the total uranium plume was located. Monitoring Well 2109 was added to provide additional monitoring coverage downgradient of Plant 6. Monitoring locations are listed below and shown in Figure 3-11.

LIST OF PLANT 6 AREA MONITORING WELLS

2054	2109	2118	2389	3054

Water samples will be collected semiannually from the five monitoring wells and analyzed for the four constituents which have been characterized as >MP in this area (Aquifer Zone 3). In addition, samples will be collected annually from the five locations and analyzed for the 14 constituents characterized as >N and the eight constituents categorized as <MP in Aquifer Zone 3 (Table 3-2). Section 3.4.2.3 and Appendix A provide additional information on the selection process. The 26 constituents to be monitored in this area are listed below. In 2001, <N constituents will be analyzed for once. The <N constituents are listed below separately.



LEGEND:

FEMP BOUNDARY

2054 ✧ TYPE 2 MONITORING WELL

3054 ✦ TYPE 3 MONITORING WELL

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FIGURE 3-11. PLANT 6 AREA MONITORING WELLS

LIST OF CONSTITUENTS WHICH WILL BE SAMPLED IN THE PLANT 6 AREA MONITORING WELLS

Constituents Categorized as ">MP" Shown in **Bold** are Analyzed Semiannually
All <MP and >N Constituents Analyzed Annually

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	Neptunium-237	alpha-Chlordane
Nitrate/Nitrite	Arsenic	**Strontium-90**	Bromodichloromethane
	Beryllium	Technetium-99	Carbon disulfide
	Boron	Thorium-228	1,2-Dichloroethane
	Cadmium	**Uranium, Total**	Vinyl chloride
	Cobalt		
	Lead		
	Manganese		
	Mercury		
	Molybdenum		
	Nickel		
	Selenium		
	Vanadium		
	Zinc		

LIST OF "<N" CONSTITUENTS WHICH WILL BE SAMPLED IN 2001 IN THE PLANT 6 AREA MONITORING WELLS

All <N Constituents Analyzed Once Every Five Years

Inorganic	Radionuclide	Organic
Barium	Radium-226	aroclor-1254
Copper	Radium-228	Benzene
Silver	Thorium-230	bis(2-Chloroisopropyl)ether
	Thorium-232	bis(2-Ethylhexyl)phthalate
		Bromomethane
		Carbazole
		Chloroethane
		Chloroform
		1,1-Dichloroethane
		1,1-Dichloroethene
		Methylene chloride
		4-Methylphenol
		4-Nitrophenol
		Octachlorodibenzo-p-dioxin
		2,3,7,8-Tetrachlorodibenzo-p-dioxin
		Trichloroethene

3.5.1.6 Routine Water-Level Monitoring

The water table in the Great Miami Aquifer and its response to seasonal fluctuations has been well characterized in the Remedial Investigation Report for Operable Unit 5. Water-level data have been routinely collected at the FEMP since 1988. Water-level data are used to evaluate seasonal variations and determine groundwater flow directions. This is accomplished by preparing hydrographs and maps of the water table in the Great Miami Aquifer. During the remediation phase of the CERCLA process, water levels will be monitored across the site to assess the effects of extraction and re-injection operations on the water table and flow conditions within the Great Miami Aquifer.

The Great Miami Aquifer is an unconfined aquifer and responds rapidly to recharge events. Data collected at the FEMP and reported in the Operable Unit 5 Remedial Investigation Report document that no strong vertical gradients exist in the area of the FEMP. Water level monitoring will rely mostly on data from Type 2 wells, which will be supplemented as necessary with data from Type 3 and Type 6 wells.

The 134 monitoring wells which were selected for water-level monitoring in 2001 and 2002 are shown in Figure 3-12 and listed below. This respresents a net reduction of 46 wells from the last version of the IEMP. Fifty wells were removed from the monitoring activity and four were added. Of the 50 removed, four wells (2033, 2423, 2551, and 3551) were plugged and abandoned. The 16 extraction wells (31550, 31560, 31561, 31562, 31563, 31564, 31565, 31566, 31567, 32276, 32308, 32309, 3924, 3925, 3926, and 3927) were removed from the quarterly IEMP monitoring activity. Water levels in extraction wells are being monitored as part of the wellfield operation program so collection of quarterly measurements was not needed. Thirty Type 3 monitoring wells (3011, 3020, 3043, 3044, 3066, 3067, 3070, 3091, 3092, 3093, 3096, 3097, 3098, 3108, 3126, 3128, 3417, 3421, 3423, 3424, 3426, 2429, 3431, 3432, 3636, 3679, 3733, 3897, 3898, and 3899) were removed from the IEMP monitoring acitivity. Concurrence for removing these thirty Type 3 monitoring wells was reached in responses to OEPA comments on the 1999 Annual Review of the IEMP, Revision 1 in March of 2000. Four new monitoring wells were added to the activity; Monitoring Well 2010 in the waste storage area, Monitoring Well 2109 in the Plant 6 area, and Monitoring Wells 62408 and 62433 in the South Field area.

Groundwater elevation monitoring locations were selected to provide areal coverage across all areas of the FEMP with an increasing density of wells in areas surrounding active aquifer restoration modules. Groundwater elevations will be measured quarterly in these wells to provide data for construction of water table elevation maps. These maps will be used to determine the location of flow divides, capture zones, and stagnation zones created by the operation of remediation modules. Additional monitoring

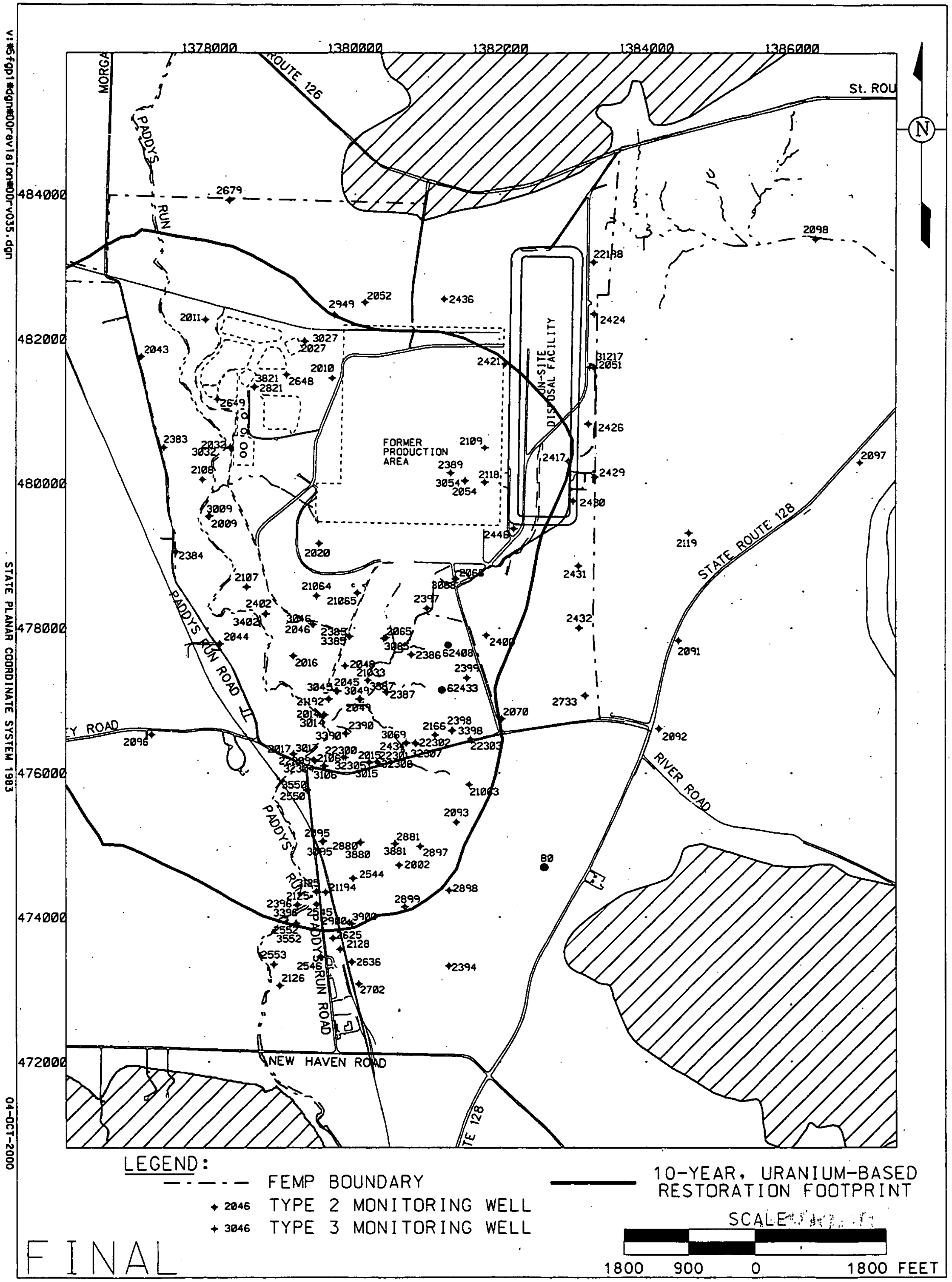


FIGURE 3-12. GROUNDWATER ELEVATION MONITORING WELLS

LIST OF GROUNDWATER ELEVATION MONITORING WELLS

80	2095	2402	2881	3054
2002	2096	2417	2897	3065
2009	2097	2421	2898	3068
2010	2098	2424	2899	3069
2011	2106	2426	2900	3095
2014	2107	2429	2949	3106
2015	2108	2430	21033	3125
2016	2109	2431	21063	3385
2017	2118	2432	21064	3387
2020	2119	2434	21065	3390
2027	2125	2436	21192	3396
2032	2126	2446	21194	3398
2043	2128	2544	22198	3402
2044	2166	2545	22299	3550
2045	2383	2546	22300	3552
2046	2384	2550	22301	3821
2048	2385	2552	22302	3880
2049	2386	2553	22303	3881
2051	2387	2625	3009	3900
2052	2389	2636	3014	31217
2054	2390	2648	3015	32304
2065	2394	2649	3017	32305
2068	2396	2679	3027	32306
2070	2397	2702	3032	32307
2091	2398	2733	3045	62408
2092	2399	2821	3046	62433
2093	2400	2880	3049	

wells and more frequent measurement intervals may be used near aquifer remediation modules as they become operational and as sensitive capture zones or stagnation zones are identified, or if unpredicted fluctuations in contaminant concentrations are observed.

An ongoing model performance evaluation process is critical to ensure that model predictions are useful. Therefore, water table maps with capture zones, flow divides, and stagnation zones will be produced from the collected field data and will be compared to steady state model predictions to determine how well the groundwater model is predicting actual aquifer responses during remediation. Section 3.7.1 further discusses model performance evaluation.

3.5.2 Other Monitoring Commitments

3.5.2.1 Private Well Monitoring

Sampling of private wells began on a routine basis in 1982 and was formalized in 1984 into a program called the Radiological Environmental Monitoring (private well) Program. In the past, at a property owner's request, any drinking water well near the site would be sampled for uranium. The one-time results were reported to the well owner. If any "special request" sample showed a questionable or above-background total uranium concentration, or if the well was believed to be representative of an area based on its location, then the property owner had the option to participate in the routine sampling program. This program grew to 33 wells in 1996. Wells were either sampled monthly or quarterly, depending upon the location. Sampling results were reported yearly in site environmental reports.

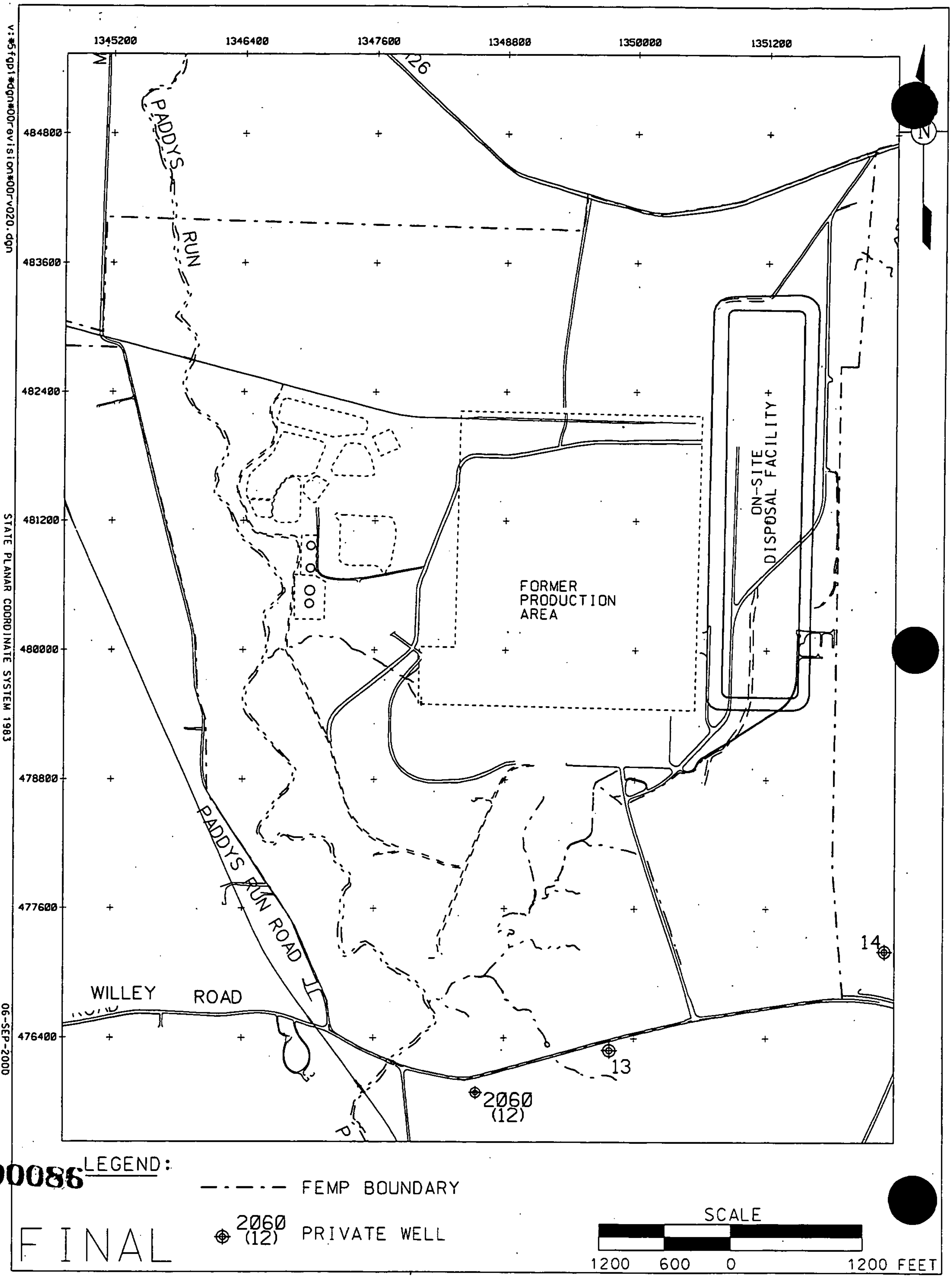
When the program was initiated, a public water supply to the area did not exist. If the total uranium concentration of the water in the private well was above the upper limit of what was considered background for uranium, then the private well user was offered bottled drinking water to preclude the use of affected wells as a drinking water source. In 1996 with the arrival of the DOE-funded public water supply, the need for bottled water was eliminated, therefore ending the need for an extensive private well sampling program.

In 2001 and 2002 three private wells (12, 13, and 14) will be sampled quarterly for total uranium. Figure 3-13 shows the location of these three wells. Private well number 12 is also identified as Monitoring Well 2060. Continuing to add to the historical database at these three private well locations is beneficial for facilitating discussions with area stakeholders on the progress of the aquifer restoration. The three locations are situated immediately downgradient of the FEMP property boundary.

3.5.2.2 Property Boundary Monitoring

The focus of the Property Boundary Groundwater Monitoring activity is to detect and assess potential changes in groundwater conditions at the FEMP property boundary. This was accomplished from 1997 to 2000 through quarterly sampling of 33 wells at three different depths (Types 2, 3, and 4 wells) located along the downgradient property boundary.

The Property Boundary Groundwater Monitoring activity evolved from the Resource Conservation and Recovery Act Groundwater Monitoring Program. The RCRA Groundwater Monitoring Program was first initiated near Waste Pit 4 in 1985 to comply with federal and state RCRA hazardous waste regulations to determine if the hazardous waste unit was impacting groundwater. By 1988 monitoring results from the program indicated that Waste Pit 4 was indeed impacting the groundwater.



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FINAL

FIGURE 3-13. PRIVATE WELL MONITORING LOCATIONS

In 1991 additional waste management units at the FEMP were identified as requiring groundwater monitoring under RCRA regulations. It was necessary to develop a monitoring strategy to integrate CERCLA and RCRA monitoring activities in order to eliminate redundancies. For this reason, DOE proposed an alternate monitoring approach that was accepted by the State of Ohio in September 1993. The alternate monitoring approach consisted of groundwater contaminant characterization under CERCLA, and groundwater monitoring at the downgradient facility boundary under RCRA to detect and assess potential changes in groundwater conditions at the FEMP property boundary while the CERCLA characterization efforts were underway. With approval of the IEMP by EPA and OEPA, DOE intended that the IEMP replace the project-specific plan for the Routine Groundwater Monitoring Program along the Downgradient Boundary of the FEMP, Revision 1 (DOE 1993). The OEPA's Director's Findings and Orders were revised to facilitate this replacement. Final signature on the revised Director's Findings and Orders was obtained on September 7, 2000. The IEMP now officially replaces the Project Specific Plan for Routine Groundwater Monitoring Program along the Downgradient Boundary of the FEMP, Revision 1.

Results from monitoring in 1999 and 2000 continue to confirm that, other than the contamination comprising the South Plume, there are no concentrations of contaminants detected through the program that trigger the need for action ahead of the final groundwater remedy. Results from 1999 and 2000 also continue to confirm that there are no FRL exceedances related to the FEMP at the Type 4 well depth. Therefore , beginning in 2001, the Type 4 wells, with the exception of Monitoring Well 4398, will be eliminated from the Property Boundary Monitoring Activity. Monitoring Well 4398 is in the Re-Injection Module area. Continued Type 4 depth monitoring at this location would be useful in determining if re-injection is acting to push the uranium plume deeper into the aquifer. Removing the other Type 4 wells from the program will decrease the number of wells from 33 to 28.

Monitoring at the downgradient property boundary during 2001 and 2002 will document if any contamination greater than the FRLs is passing the property boundary and entering the public domain. The 28 property boundary monitoring wells that will be sampled in 2001 and 2002 are shown in Figure 3-14 and listed below.

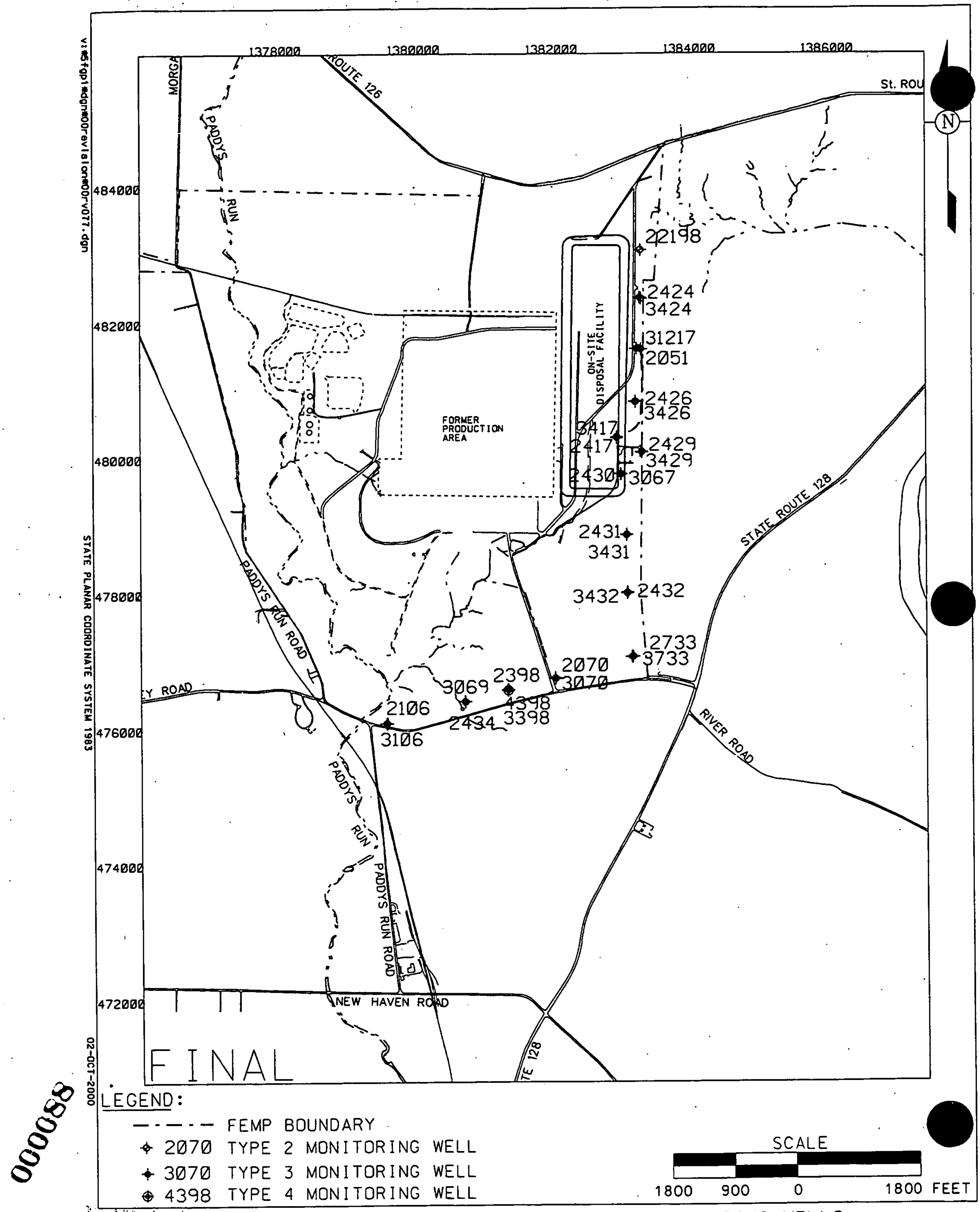

FIGURE 3-14. PROPERTY BOUNDARY MONITORING WELLS

LIST OF PROPERTY BOUNDARY MONITORING WELLS

2051	2070	2106	22198	2398	2417	2424
2426	2429	2430	2431	2432	2434	2733
3067	3069	3070	3106	31217	3398	3417
3424	3426	3429	3431	3432	3733	4398

The constituent list for this monitoring activity is presented below. Section 3.4.2.3 and Appendix A provide additional information on the selection process. Monitoring will focus on the FRL constituents that have had a FRL exceedance in the aquifer zones upgradient of the property boundary (Aquifer Zones 0, 1, 2, and 3). Those constituents that have not yet caused a FRL exceedance in zones upgradient of the property boundary will be monitored upgradient of the boundary wells. Should a new exceedance be documented, then the constituents will be added to the list. Quarterly sampling will be conducted for the eight constituents categorized as >MP in Aquifer Zones 0, 1, 2, or 3 and the 18 constituents categorized as >N in Aquifer Zones 0, 1, 2, or 3. The <MP and <N constituents will be monitored once in 2001. The <N and <MP constituents are listed separately below.

LIST OF >MP AND >N CONSTITUENTS WHICH WILL BE ANALYZED QUARTERLY IN THE PROPERTY BOUNDARY MONITORING WELLS

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	Neptunium-237	Benzene
Nitrate/Nitrite	Arsenic	Strontium-90	Carbon disulfide
	Beryllium	Technetium-99	Trichloroethene
	Boron	Thorium-228	
	Cadmium	Thorium-232	
	Cobalt	Uranium, Total	
	Lead		
	Manganese		
	Mercury		
	Molybdenum		
	Nickel		
	Selenium		
	Silver		
	Vanadium		
	Zinc		

LIST OF <N and <MP CONSTITUENTS WHICH WILL BE ANALYZED IN 2001 IN THE PROPERTY BOUNDARY MONITORING WELLS

Inorganic	Radionuclide	Organic
Barium	Radium-226	Aroclor-1254
Copper	Radium-228	bis(2-Chloroisopropyl)ether
	Thorium-230	bis(2-Ethylhexyl)phthalate
		Bromomethane
		Carbazole
		Chloroethane
		Chloroform
		1,1-Dichloroethane
		1,1-Dichloroethene
		Methylene chloride
		4-Methylphenol
		4-Nitrophenol
		Octachlorodibenzo-p-dioxin
		2,3,7,8-Tetrachlorodibenzo-p-dioxin
		Alpha-chlordane
		bromodichloromethane
		1,2-dichloroethane
		vinyl chloride

3.6 MEDIA-SPECIFIC PLAN FOR GROUNDWATER MONITORING

This section serves as the media-specific plan for implementation of the sampling, analysis, and data management activities associated with the sitewide environmental groundwater monitoring program. The program expectations and design presented in Section 3.4 were used as the framework for developing the monitoring approach presented in this section. The activities described in this media-specific plan have been designed to provide groundwater data of sufficient quality to meet the program expectations as defined in Section 3.4.1. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 1998a).

Subsequent sections of this media-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance.

3.6.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this media-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to media activities must be approved by the team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support and assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standard and assist in evaluating and resolving all quality related concerns.

3.6.2 Sampling Program

The information derived from the groundwater monitoring program should produce a clear understanding of groundwater quality in the Great Miami Aquifer. The groundwater sampling process will be controlled so that collected samples are representative of groundwater quality. All procedures for monitoring well development, sample collection, and shipment will be performed in accordance with directives established in the SCQ. Table 3-4 provides a summary listing of the monitoring wells that comprise the overall sampling program (numerically sorted by well number).

Figure 3-15 identifies all monitoring well locations for 2001 and 2002. Individual well lists for each module or monitoring program, analytical constituent lists, and location maps are presented in Sections 3.5.1 through 3.5.2.

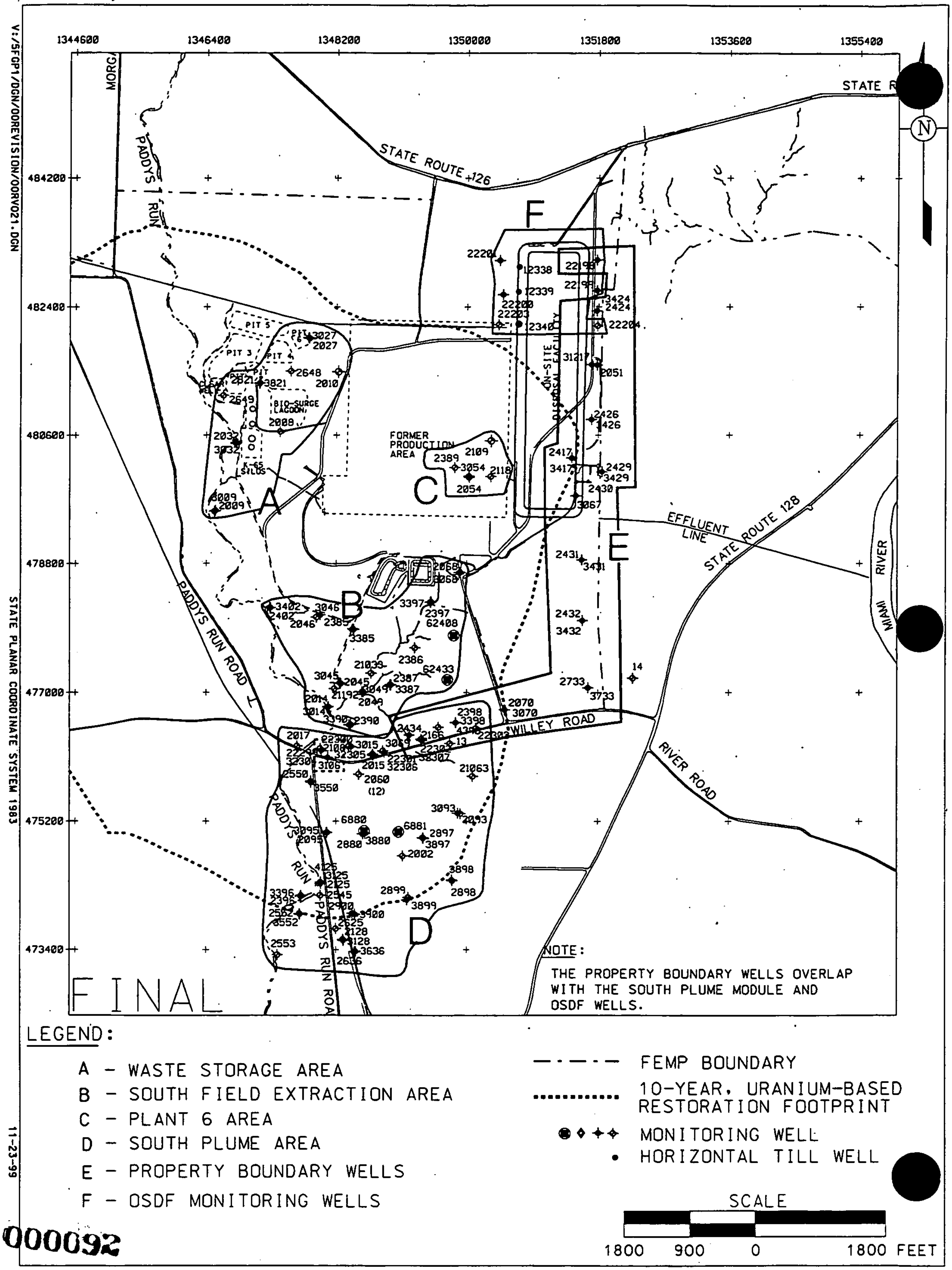

FIGURE 3-15. IEMP WATER QUALITY MONITORING WELLS FOR 2001 AND 2002

TABLE 3-4

LISTING OF IEMP GROUNDWATER WELLS

Well No.	Well ID	Monitoring Activity[a]
1	13	Private Well Monitoring
2	14	Private Well Monitoring
3	2002	South Plume Module
4	2008	Waste Storage Area Module
5	2009	Waste Storage Area Module
6	2010	Waste Storage Area Module
7	2014	South Field Extraction Module
8	2015	South Plume Module
9	2017	South Plume Module
10	2027	Waste Storage Area Module
11	2032	Waste Storage Area Module
12	2045	South Field Extraction Module
13	2046	South Field Extraction Module
14	2049	South Field Extraction Module
15	2051	Property Boundary Monitoring
16	2054	Plant 6 Area
17	2060 (12)	Private Well Monitoring
18	2068	South Field Extraction Module
19	2070	Property Boundary Monitoring
20	2093	South Plume Module
21	2095	South Plume Module
22	2106	South Plume Module Property Boundary Monitoring
23	2109	Plant 6 Area
24	2118	Plant 6 Area
25	2125	South Plume Module
26	2128	South Plume Module
27	2166	South Plume Module
28	2385	South Field Extraction Module
29	2386	South Field Extraction Module
30	2387	South Field Extraction Module
31	2389	Plant 6 Area
32	2390	South Field Extraction Module
33	2396	South Plume Module
34	2397	South Field Extraction Module
35	2398	South Plume Module Property Boundary Monitoring
36	2402	South Field Extraction Module
37	2417	Property Boundary Monitoring
38	2424	Property Boundary Monitoring
39	2426	Property Boundary Monitoring
40	2429	Property Boundary Monitoring
41	2430	Property Boundary Monitoring
42	2431	Property Boundary Monitoring
43	2432	Property Boundary Monitoring
44	2434	Property Boundary Monitoring

TABLE 3-4
(Continued)

Well No.	Well ID	Monitoring Activity[a]
45	2545	South Plume Module
46	2550	South Plume Module
47	2552	South Plume Module
48	2553	South Plume Module
49	2625	South Plume Module
50	2636	South Plume Module
51	2648	Waste Storage Area Module
52	2649	Waste Storage Area Module
53	2733	Property Boundary Monitoring
54	2821	Waste Storage Area Module
55	2880	South Plume Module
56	2897	South Plume Module
57	2898	South Plume Module
58	2899	South Plume Module
59	2900	South Plume Module
60	3009	Waste Storage Area Module
61	3014	South Field Extraction Module
62	3015	South Plume Module
63	3027	Waste Storage Area Module.
64	3032	Waste Storage Area Module
65	3045	South Field Extraction Module
66	3046	South Field Extraction Module
67	3049	South Field Extraction Module
68	3054	Plant 6 Area
69	3067	Property Boundary Monitoring
70	3068	South Field Extraction Module
71	3069	South Plume Module Property Boundary Monitoring
72	3070	Property Boundary Monitoring
73	3093	South Plume Module
74	3095	South Plume Module
75	3106	South Plume Module Property Boundary Monitoring
76	3125	South Plume Module
77	3128	South Plume Module
78	3385	South Field Extraction Module
79	3387	South Field Extraction Module
80	3390	South Field Extraction Module
81	3396	South Plume Module
82	3397	South Field Extraction Module
83	3398	Property Boundary Monitoring
84	3402	South Field Extraction Module
85	3417	Property Boundary Monitoring
86	3424	Property Boundary Monitoring
87	3426	Property Boundary Monitoring
88	3429	Property Boundary Monitoring
89	3431	Property Boundary Monitoring
90	3432	Property Boundary Monitoring

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TABLE 3-4
(Continued)

Well No.	Well ID	Monitoring Activity[a]
91	3550	South Plume Module
92	3552	South Plume Module
93	3636	South Plume Module
94	3733	Property Boundary Monitoring
95	3821	Waste Storage Area Module
96	3880	South Plume Module
97	3897	South Plume Module
98	3898	South Plume Module
99	3899	South Plume Module
100	3900	South Plume Module
101	4125	South Plume Module
102	4398	Property Boundary Monitoring
103	6880	South Plume Module
104	6881	South Plume Module
105	21033	South Field Extraction Module
106	21063	South Plume Module
107	21192	South Field Extraction Module
108	22198	Property Boundary Monitoring
109	22299	Re-Injection Module
110	22300	Re-Injection Module
111	22301	Re-Injection Module
112	22302	Re-Injection Module
113	22303	Re-Injection Module
114	31217	Property Boundary Monitoring
115	32304	Re-Injection Module
116	32305	Re-Injection Module
117	32306	Re-Injection Module
118	32307	Re-Injection Module
119	62408	South Field Extraction Module
120	62433	South Field Extraction Module

[a]Refer to Section 3.5 for details on monitoring. This table excludes the on-site disposal facility and water level monitoring wells.

Sample analysis will be performed at the on-site FEMP laboratory or a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Section 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

3.6.2.1 Sampling Procedures

All monitoring wells will be purged and sampled using the guidelines specified in Section 6.2 and K.4.2 of the SCQ which have been incorporated into the standard operating procedures utilized for conducting groundwater sampling. The applicable SCQ sections and operating procedures pertaining to groundwater sampling are as follows:

Standard Operating Procedures	
SMPL-02	Liquids and Sludge Sampling
SMPL-05	Groundwater Level/Total Depth Measurements
SMPL-21	Collection of Field Quality Control Samples
ADM-02	Field Project Prerequisites
ADM-03	Water Sample Shipment
EQT-02	Horiba Water Quality Meter
EQT-04	Photoionization Detector
EQT-10	Gasoline Powered Engines
EQT-28	Hydrolab Multiparameter Water Quality Monitoring Instrument
EW-0002	Chain of Custody/Request for Analysis Record for Sample Control

Sitewide CERCLA Quality (SCQ) Assurance Project Plan	
Section 4	Quality Assurance Objectives
Section 5	Field Activities
Section 6	Sampling Requirements
Section 7	Sample Custody
Section 8	Calibration Procedures and Frequency
Appendix I	Field Calibration Requirements
Appendix J	Field Activity Methods
Appendix K	Sampling Methods

Table 3-5 summarizes the field sampling information by analytical constituent groups and includes the analytical support level (ASL), holding time, preservative, container requirement, and analytical method. The volume of purge water to be removed from monitoring and extraction wells is specified in procedure SMPL-02, Liquids and Sludge Sampling. The purge volume for sampling of groundwater via spigots or valves for the South Plume Module wells will be two gallons as long as the extraction well pumps are in continuous operation. One water quality reading is required prior to groundwater sample collection at these spigot locations.

An objective of the IEMP groundwater-monitoring program is to collect and analyze representative groundwater samples. The sample analysis for metals and radionuclides should quantify species that are dissolved, occur as mobile precipitates, or are adsorbed onto mobile particles. If immobile particles to which metals are bound are allowed to remain in field-acidified samples, laboratory analysis will overstate the true concentration of mobile species present in the sample because acidification dissolves precipitates or causes adsorbed metals to desorb. Turbidity readings and the use of filtration to obtain a representative sample are therefore important field concerns for collection of groundwater samples.

Consistent with OEPA guidelines, 5 nephelometric turbidity units (NTU) will serve as the cut off for a representative groundwater sample and for determining when filtration of the sample to be analyzed for metals/radionuclides is required. Routine filtration will be avoided at the FEMP whenever possible. Proper well construction and maintenance will be practiced in order to help keep the turbidity of unfiltered groundwater samples at or below 5 NTU. If after properly purging a monitoring well, the sample turbidity is greater than 5 NTU, then the sample will be filtered through a 5-micron filter. If the turbidity of the 5-micron filtered sample is still above 5 NTU, then the 5-micron filtered sample will be additionally filtered through a 0.45-micron filter. Both the unfiltered and final filtered uranium sample will be analyzed. The final filtered sample will be analyzed for metals and radionuclides only.

TABLE 3-5

ANALYTICAL REQUIREMENTS FOR THE GROUNDWATER MONITORING PROGRAM

Constituent	Method	Sample Type	ASL[a]	Holding Time[b]	Preservative[b]	Container[b,c]
General Chemistry:						
Cyanide	9010B[d], 9012A[d], 335.2[e], or 335.3[d]	Grab	B	14 days	Cool to 4°C, NaOH to pH > 12	Plastic or glass
Fluoride	300.0[e], 340.2[e], or 4500C[f]	Grab	B	28 days	None	Plastic
Nitrate/Nitrite	353.1[e], 353.2[e], 4500D[f], or 4500E[f]	Grab	B	28 days	Cool to 4°C, H_2SO_4 to pH < 2	Plastic or glass
Phosphorus	365.(all)[e] or 4500E[f]	Grab	B	28 days	Cool to 4°C, H_2SO_4 to pH < 2	Plastic or glass
Inorganics:						
Metals Excluding Mercury	6020[d], 7000A[d], 6010B[d] or	Grab	B	6 months	HNO_3 to pH < 2	Plastic or glass
Mercury	7470A[d]/7471A[d]	Grab	B	28 days	HNO_3 to pH < 2	Plastic or glass
Radionuclides: (All Radiological)	SCQ[g]	Grab	B	Six months or 5x half-life, whichever is less	HNO_3 to pH < 2	Plastic or glass
Volatile Organics:	8260B[d]	Grab	B	7 days	Cool to 4°C	Glass vial with Teflon lined septum cap
		Grab	B	14 days	Cool to 4°C H_2SO_4, HCl, or solid $NaHSO_4$ to pH < 2	Glass vial with Teflon lined septum cap
Pesticides[h]:	8081A[d]	Grab	B	7 days to extraction 40 days from extraction to analysis	Cool to 4°C	Amber glass bottle with teflon lined cap
Field Parameters[i]:	SCQ[j]	Grab	A	NA[k]	NA[k]	NA[k]

[a]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[b]Appropriate preservative, holding time, and container will be used for the corresponding method.
[c]Container size is left to the discretion of the individual laboratory.
[d]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846
[e]Methods for Chemical analysis of Water and Wastes, EPA 600/4-79-020
[f]Standard Methods for the Analysis of Water and Wastewater, 17th edition
[g]Radionuclide analyses do not have standard methods; however, the analytical specifications for these constituents are provided in Appendix G of the SCQ.
[h]The pesticide that will be analyzed is alpha-chlordane.
[i]Field parameters include dissolved oxygen, pH, specific conductance, temperature, and turbidity.
[j]Appendix K of the SCQ provides field analytical methods.
[k]NA = not applicable

3.6.2.2 Quality Control Sampling Requirements

Field quality control samples will be collected to assess the accuracy and precision of field and laboratory methods as outlined in Section 4.1.1 of the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as decontamination, sampling technique, or analytical method may be responsible for introducing bias in the analytical results. The following types of quality control samples will be collected: sampling equipment rinsates, trip blanks, field blanks, and duplicate samples, as outlined in Section 4 and Appendix A of the SCQ. Each quality control sample is preserved using the same method for groundwater samples. The quality control sample frequencies will be tracked to ensure the proper frequency requirements are met as follows:

- Trip blanks will be prepared for each sampling team on each day of sampling when volatile organic compounds are included in the respective analytical program.
- Equipment rinsates will be collected for every 20 groundwater samples that are collected using reusable sampling equipment. If a specific sampling activity consists of less than 20 groundwater samples, then a rinsate sample will still be required. Rinsates are not required when dedicated well equipment or disposable sampling equipment is utilized.
- Field blanks will be collected for each day of groundwater sampling.
- Field duplicates will be collected for every 20 groundwater samples or fraction thereof if the specific sampling program consists of less than 20 samples.

The groundwater samples associated with each quality control sample also will be tracked to ensure traceability in the event that contaminants are detected in the quality control samples.

3.6.2.3 Decontamination

In general, decontamination of equipment is minimized due to limited use of reusable equipment during sample collection. However, if decontamination is required, then equipment will be cleaned between sample locations. The decontamination shall be Level II decontamination as referenced in Section K.11 of the SCQ. The specific details are outlined in procedure SMPL-02, Liquids and Sludge Sampling.

3.6.2.4 Waste Disposition

The following wastes will be generated during sampling activities:

- Purge water and decontamination solutions
- Contact wastes.

The following subsections provide the proposed disposition methodology for each type of waste generated.

Purge Water and Decontamination Solutions

Groundwater purged from the wells and solutions used to decontaminate equipment used during sampling will be containerized for proper disposal. For each batch of wastewater, a Wastewater Discharge Request Form is submitted to the FEMP compliance organization for direction and approval for disposition. This wastewater is routinely disposed of at the Storm Water Retention Basin or the Advanced Wastewater Treatment Plant dependent on the point of origin.

Contact Wastes

Contact wastes such as personal protective equipment, paper towels, and other solid, investigation-derived waste will be placed in plastic bags or 55-gallon drums and transported to the FEMP for disposition if it was generated at off-site locations. Contact wastes generated inside a radiologically controlled or contamination area will be dispositioned to a controlled waste container in the respective area.

3.6.2.5 Monitoring Well Maintenance

During the restoration of the FEMP, surface cleanup activities will create adverse conditions around several groundwater monitoring wells. Extra effort will be taken on the part of FEMP personnel to safeguard and inspect groundwater monitoring wells during FEMP restoration. Monitoring well maintenance will center around two questions:

1) Is the monitoring well protective of the subsurface environment in its current condition?
2) Does the monitoring well yield a representative groundwater sample?

Well Maintenance Inspections

Routine inspections of Great Miami Aquifer groundwater monitoring wells will be conducted during sampling or collection of water levels (at a minimum of once a year if the well is not being routinely sampled) to determine if the well is protective of the environment based on the inspection criteria below. Wells may be inspected more frequently if they are located in an area of active surface restoration. All assessment and maintenance activities will be recorded on applicable field data forms. The inspections include, but are not limited to, the following:

- Ensure that the well identification number is painted or welded on the top of the lid
- Inspect the ground surrounding the well for depressions and channels that allow surface water to collect and flow towards the wellhead, and for debris and foreign material that could leach contaminants into the subsurface or otherwise interfere with well sampling
- Ensure visibility and accessibility to the well
- Inspect locking lids and padlocks to check for rust and ease of operation
- Inspect the exposed (protective) well casing to ensure that it is free of cracks and signs of corrosion; it is reasonably plumb with the ground surface; it is painted bright orange; the drain hole is clear; it is free of debris; and the well casing has no sharp edges
- Remove and inspect the well cap to ensure that it is free of debris; fits securely and the vent hole is clear; and, if equipped with a ground-flush cap, ensure that it is water-tight to prevent surface water from entering the well
- Inspect concrete surface seals for settling and cracking
- If exterior guards are used to protect the well, then periodically inspect the guards for visibility and damage and repaint, if necessary.

Well Evaluation

If the turbidity and amount of sediment measured in the well and/or the visual inspection indicate a potential problem with the well, then the following work may be performed to evaluate the cause of the sedimentation or other problems:

- Review existing well installation documentation
- Review well history and historical water quality data to identify whether it produces consistently clear or turbid samples
- Review groundwater sampling field records
- Conduct a downhole camera survey to inspect the integrity of the screen and casing.

At least once a year, an assessment will be made of wells that are sampled as to whether or not the well is yielding a representative sample. This assessment includes, but is not limited to, the following:

- Determine how much sediment has entered the well screen and accumulated in the well and review historical depth records. This will be done by measuring the well depths for those wells that do not have dedicated packers.
- Determine if any foreign material is present in the well (e.g., bentonite grout)
- Determine if the groundwater color has changed over time (e.g., due to iron bacteria)
- Evaluate turbidity within the sample.

Well Maintenance Corrective Actions

Corrective actions to address problems identified in the well maintenance inspections will be conducted as soon as feasible. Corrective maintenance to address excessive turbidity will include removal of sediment from the well through redevelopment of the well.

The possibility exists that minerals can precipitate on well screens. If it is determined that minerals have precipitated in the well or on the well screen, and they are affecting the representativeness of the groundwater sample, then the limited use of chemicals (e.g., chlorine, hydrochloric acid, etc.) to remove the mineral build-up may be considered. It is understood that chemicals have a very limited application in the rehabilitation of monitoring wells because the chemicals can cause changes such that the well will no longer yield a representative sample (Aller et al 1989). Changes resulting from the use of chemicals could last for a short time or could be permanent. Therefore, if chemical rehabilitation is attempted, it will only be attempted as a last resort. Water quality parameters, such as Eh (redox potential), pH, temperature, and conductivity, will be measured prior to the application of the chemicals and following the use of the chemicals. These measurements will serve as values for comparison of water quality before and after well maintenance.

If a groundwater monitoring well has been damaged in such a way that it is no longer protective of the subsurface environment and it cannot be repaired, then the well will be plugged and abandoned. If it is determined that the well is not yielding a representative groundwater sample and rehabilitation efforts are not effective in correcting the condition, then the well will be considered for plugging and abandonment. If the well is still protective of the subsurface environment, then it might be used for the collection of water level data even though it does not yield representative groundwater samples.

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3.6.3 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have approval by the designee and quality assurance representative prior to implementation. In accordance with Section 15.3 of the SCQ, the completed Variance/Field Change Notice must be approved by quality assurance within one week of verbal approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members, included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the media-specific plan.

3.6.4 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this media-specific plan. Safety meetings will be conducted prior to beginning field work to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed applicable training.

For areas which are subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a radiation work permit.

3.6.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2001 and 2002 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated.

Field data validation will consist of verifying media-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with media-specific plan specified ASLs. Specific requirements for field data documentation and validation, and laboratory data documentation and validation in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. For groundwater in 2001 and 2002, field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives. In general, ASL B is appropriate for laboratory generated data collected in 2001 and 2002, because the data are being used for surveillance during site restoration. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

3.6.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ and FEMP Quality Assurance Program (RM-0012) requirements.

Recommended quarterly quality assurance assessments or surveillances shall be performed on tasks specified in the media-specific plan. These assessments may be in the form of independent assessments or self-assessments, with at least one independent assessment conducted annually. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

3.7 IEMP GROUNDWATER MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP groundwater sampling program in 2001 and 2002. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated groundwater data, including specific information to be reported in IEMP quarterly summaries and in annual integrated site environmental reports, is also provided.

3.7.1 Data Evaluation

Data resulting from the IEMP groundwater program will be evaluated to meet the program expectations identified in Section 3.4.1. Based on these expectations, the following questions will be answered through the groundwater data evaluation process, as indicated:

- How is the groundwater restoration system operating?

Operation of the groundwater restoration system will be assessed by tracking:

- Pumping/re-injection rates
- Operational efficiency of individual wells
- Volumes of water pumped/re-injected
- Pounds of uranium removed
- Uranium removal rates
- Total uranium concentration data collected from extraction wells
- Total uranium concentration data collected from monitoring wells.

Most of the data will either be tabulated or presented in graphs. Uranium removal rates will be determined by dividing the pounds of uranium removed by the millions of gallons of water pumped.

- Are aquifer restoration expectations for 2001 and 2002 being met?

A variety of expectations were presented in Section 3.4.1 for the IEMP groundwater monitoring system. To achieve these expectations, groundwater monitoring program data will be evaluated to:

- Assess progress in capturing and restoring the area containing the > 20 µg/L total uranium plume
- Assess progress in capturing and restoring the areas affected by non-uranium FRL exceedances
- Assess water quality at the downgradient FEMP Property Boundary
- Assess groundwater model predictions of remedy performance
- Assess the impact that the aquifer restoration is having on the Paddys Run Road Site plume
- Meet other monitoring commitments
- Address community concerns.

The aquifer restoration system is being designed to reduce the concentration of uranium and non-uranium FRL constituents in the aquifer to concentrations that are at or below their FRL. Because uranium is the principal constituent of concern, the aquifer restoration system has been designed to capture the 20 µg/L total uranium plume, with the understanding that the system may need to be modified in the future to capture and remediate non-uranium FRL constituents.

Extraction and re-injection wells have been positioned within each restoration module with this first objective in mind. Operational decisions and pumping/re-injection changes will focus on this first objective in 2001 and 2002. Operational changes to meet non-uranium FRL concentrations are considered to be a secondary objective in 2001 and 2002. However, evaluation of the need for an operational change to address non-uranium FRL constituents will be an ongoing process throughout the course of the aquifer remediation and is expected to gain in importance as the achievement of the uranium objective approaches.

Following is a discussion of how each of the groundwater program expectations are intended to be met through evaluation of IEMP groundwater data.

<u>Capturing and Restoring the Area Containing the Greater than 20 µg/L Total Uranium Plume</u>
Capture and restoration of the area containing the > 20 µg/L total uranium plume will be evaluated using groundwater elevation and flow direction data and the most current uranium plume depiction based on the sampling data. When a restoration module begins operating, water levels will be collected very frequently (i.e., weekly) until conditions have stabilized. Once conditions have stabilized, monitoring will for the most part fall back to a quarterly schedule. Individual module start-up plans will provide specifics on the frequency of water level and water quality data collection during start-up. Groundwater elevation maps with capture zones and flow divides will be prepared to evaluate the extent of capture.

Remediation of the 20 μg/L total uranium plume will be assessed by monitoring total uranium concentrations. The 20 μg/L total uranium plume will be mapped and compared against modeling predictions of plume size and concentration to evaluate whether or not design expectations for uranium restoration are being achieved.

If a new total uranium FRL exceedance is detected in the aquifer, then an attempt will be made to determine the cause of the exceedance. Considerations will include:

- Movement of known total uranium contamination in response to pumping, re-injection, or natural migration
- New contamination reaching the aquifer as a result of FEMP restoration activity
- Previously undetected uranium contamination that has now moved into a monitoring zone as a result of pumping, re-injection, or natural migration.

Capturing and Restoring the Areas Affected by Non-Uranium FRL Exceedances

The Operable Unit 5 Record of Decision identifies 49 FRL constituents, other than total uranium, that also need to be tracked as part of the aquifer restoration. These 49 constituents are collectively referred to as the non-uranium FRL constituents. During the aquifer restoration, groundwater monitoring will take place in each restoration module for the non-uranium FRL constituents. Constituents that have been detected in the aquifer above their respective FRL will be monitored more frequently than those which have not been detected above their respective FRL. As explained in Section 3.4.2.3, non-uranium FRL constituents are monitored quarterly, semiannually, annually, or once every five years depending on the particular constituent and the monitoring locations.

Non-uranium FRL concentrations in the Great Miami Aquifer will be assessed through trend analysis when sufficient data have been obtained. The Mann-Kendall statistical test for trend will be utilized to facilitate the trending interpretation. Concentrations versus time plots may be used to illustrate how the concentrations are trending.

If a new non-uranium FRL exceedance is detected in the aquifer, then an attempt will be made to determine the cause of the exceedance. Considerations will include:

- Movement of known contamination in response to pumping, re-injection, or natural migration
- New contamination reaching the aquifer as a result of FEMP restoration activity

- Previously undetected contamination that has now moved into a monitoring zone as a result of pumping, re-injection, or natural migration.

Appendix A presents criteria which will be utilized to change the sampling frequency of a non-uranium FRL constituent, if a FRL exceedance is recorded.

Any FRL exceedance detected at a property boundary well location will be evaluated utilizing the same data evaluation protocol which was approved for the Restoration Area Verification Sampling Program, Project Specific Plan (DOE 1997e) in order to determine if additional action is required. The constituent concentration data over time will be graphed. If two or more sampling events following a FRL exceedance indicate that the concentrations are below the FRL, then the location will not be considered for remediation or further monitoring above and beyond what is already prescribed by the IEMP. If sampling following the initial FRL exceedance indicates that the exceedance was not just a one-time occurrence, and the exceedance is judged to be the result of FEMP activities (either historical or current), then action will be taken to address the exceedance.

Meeting Other Monitoring Commitments

Other groundwater monitoring commitments that need to be addressed are: 1) private well sampling; 2) property boundary monitoring; 3) and fulfillment of DOE Order 5400.1 requirement to maintain an environmental monitoring program for groundwater.

Total uranium data collected at private wells will be graphed to illustrate changes and will be utilized in the preparation of total uranium contour maps. Data collected from the FEMP property boundary monitoring system will be compared to FRL values. This will facilitate the detection and monitoring of FRL exceedances and will determine if interim actions are warranted, in addition to implementing the sitewide aquifer restoration. Lastly, this groundwater monitoring program presented in the IEMP, along with the groundwater data reporting in IEMP annual integrated site environmental reports, fulfills DOE Order 5400.1 requirements.

Verifying Groundwater Model Predictions of Remedy Performance

To manage groundwater remedy performance, groundwater uranium concentration data and water-level data obtained from monitoring wells and extraction wells through the life of the remedy will be compared against modeled concentrations and water levels to evaluate if the remediation is proceeding as designed (Figure 3-16). If the remediation is not proceeding as designed, then changes will need to be made, and the groundwater model will need to be used to help in deciding which changes will occur.

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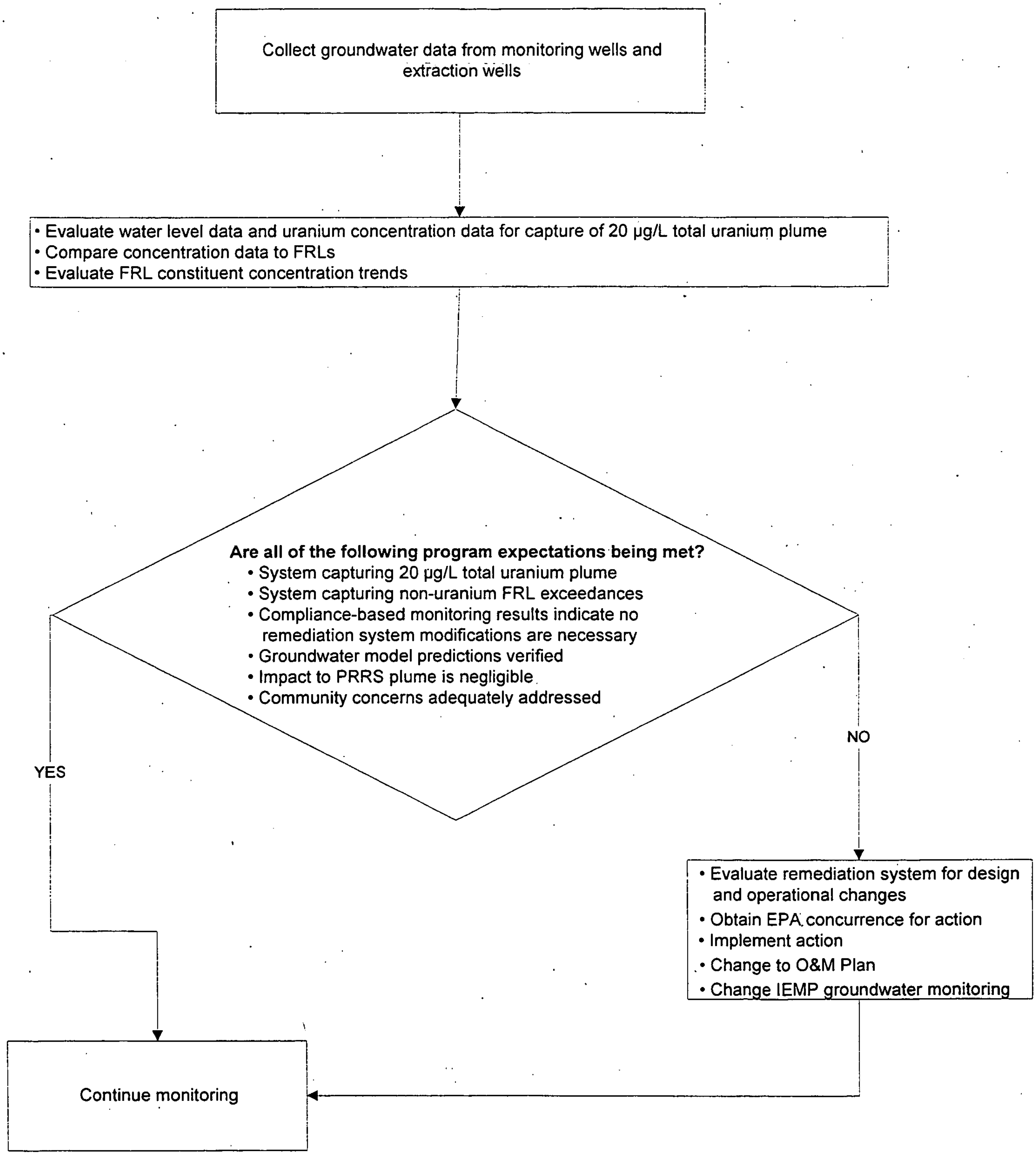
FIGURE 3-16
GROUNDWATER MONITORING DECISION-MAKING PROCESS FOR 2001 AND 2002



It is understood that the groundwater model may need to be re-calibrated in the future if monitoring indicates that the model predictions are not adequate for managing the remedy. Future model calibration efforts will be performed to the same standard used to calibrate the SWIFT model. However, the basic strategy for model performance assessment will be as follows:

- Model predicted water level values will be compared to actual field measured values. The decision to re-calibrate the groundwater model will be based on how close the model predictions are to field measured values.

- The difference between the maximum and minimum measured groundwater elevation over time will be used to define a water level elevation range for a particular well. The water level range is the result of seasonal variations and long term water level trends within the aquifer. A range of water levels over time has been established for each water level monitoring well identified in the IEMP.

- Model predicted groundwater elevations for the current pumping/re-injection configuration will be compared to measured elevations. If the difference between the actual quarterly measurement and the modeled prediction for that year is consistently (two or more consecutive quarters) greater than five feet for more than one-third of the monitoring wells within the capture zone of the extraction system, or for a significant local area of the model domain, then the need to implement model recalibration for the affected area of the model will be evaluated. All relevant groundwater data acquired since the previous model calibration will be considered in future model recalibrations.

Because predicted values only represent average conditions within a model block and because monitoring wells are usually not located at the center of a model block, the modeled elevations from a block modeled to contain the monitoring well and the surrounding eight model blocks will be used for comparison with actual measured elevations.

Model predicted contaminant concentrations profiles over time will be checked annually using concentration data collected from the aquifer at designated monitoring wells. Model predictions for concentrations through time at extraction wells and various monitoring points will be compared to actual field conditions to determine if concentrations are decreasing or increasing as predicted by the model. Designated monitoring points will be selected once the VAM3DF flow and transport model has been calibrated. Monitoring points will be selected by considering the following:

- Areas within the aquifer where modeling confidence is low
- Data from extraction wells
- Depth of existing monitoring well screens in relation to layers within the model.

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Concentration data collected in the field at select monitoring locations will be trended to determine if FRL concentrations will be achieved within the time frame predicted by the model. Differences between model predicted concentrations and measured concentrations may be the result of inaccurate transport parameter values and/or actual operational conditions (i.e., pumping and re-injection rates) not being the same as used in the model. Performance of the transport model will also be assessed by comparing mass removed versus mass predicted to be removed and the groundwater model's capability to predict the plume's general configuration. Field data will be used to determine when pumping adjustments need to be evaluated. Pumping adjustments will be evaluated using the groundwater model.

Assess the Impact that the Aquifer Restoration is Having on the Paddys Run Road Site Plume

As was done from 1997 to 2000, concentration data collected in 2001 and 2002 for key Paddys Run Road Site constituents will be evaluated using trend analysis. Water level maps will be produced to determine where capture is occurring due to pumping in the South Plume Module.

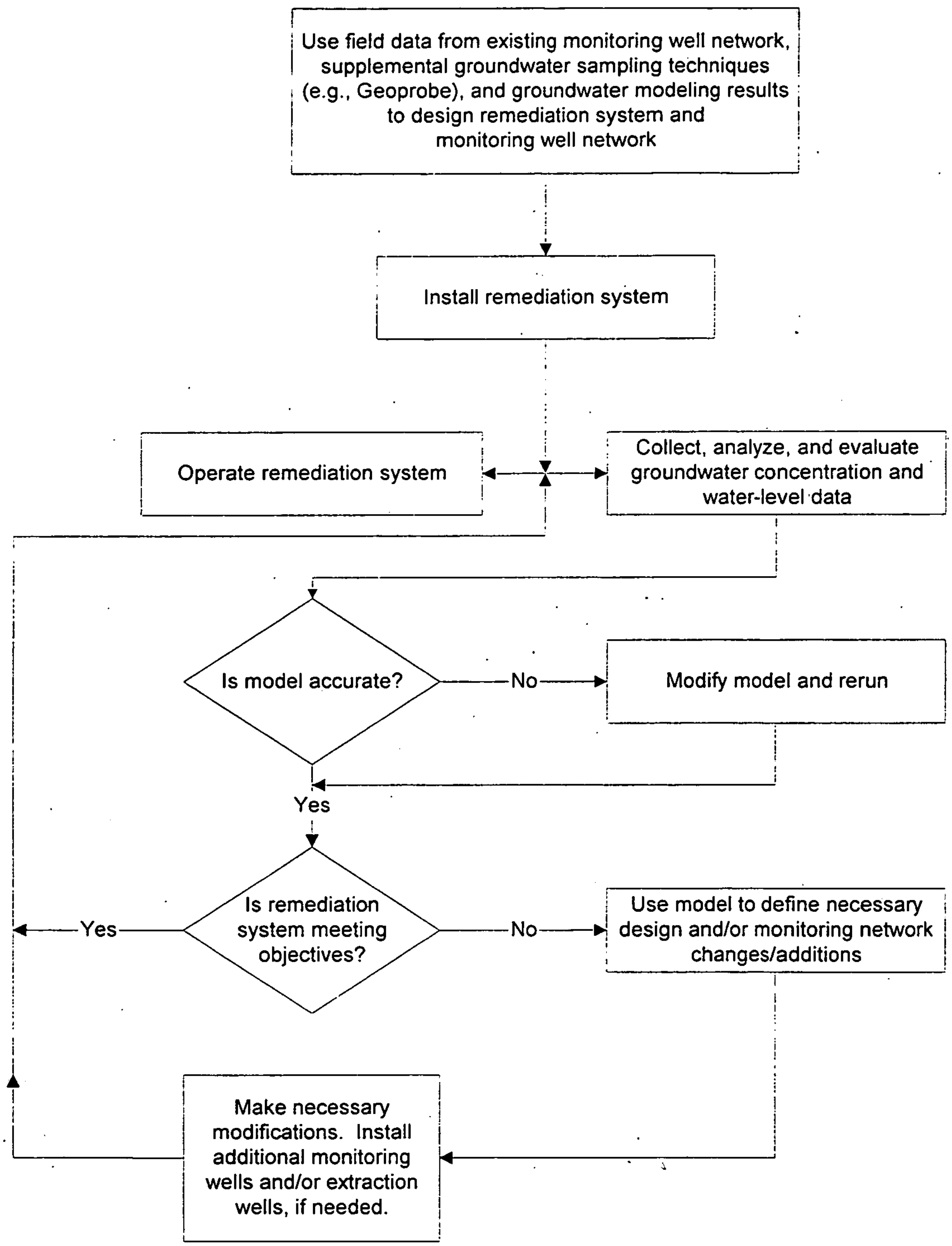
Adequately Address Community Concerns

The IEMP fulfills the needs of the Fernald community by preparing groundwater environmental results in annual integrated site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center, which is located a half mile south of the FEMP on Oakridge Drive in the Delta Building. Public comments received over the life of the IEMP program regarding the IEMP groundwater program will be considered in future revisions to the IEMP.

Overall Aquifer Restoration Decision-Making Process

Figure 3-17 illustrates the overall framework for the decision-making process for 2001 and 2002. Groundwater monitoring will be conducted at selected monitoring locations during aquifer remediation. If it is determined that program expectations for 2001 and 2002 are not being met, then the design and operation of the aquifer restoration system will be evaluated to determine if a change needs to be implemented. A change to the operation of the aquifer restoration system would be implemented through the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project (DOE 1997d). A groundwater monitoring change, if found to be necessary, would be implemented through the yearly reviews and biennial revisions of the IEMP. If additional characterization data are needed above and beyond the current scope of the IEMP, (e.g., to determine the nature of a newly detected FRL exceedance), then a separate sampling plan will be prepared. Additional sampling activities may utilize other sampling techniques, such as a Geoprobe™ sampling tool, which has been successfully used at the FEMP to obtain groundwater samples without the use of a permanent monitoring well.

FIGURE 3-17
AQUIFER RESTORATION DECISION-MAKING PROCESS



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In the past, groundwater data have been presented and evaluated in the following manner:

- Concentration versus time plots for specific constituents
- Tables identifying wells with constituents above FRL concentrations
- Mann-Kendall trend analyses for specific constituents
- Concentration contour maps.

Through the lifetime of the aquifer restoration, large quantities of data will be collected and evaluated. As in the past, DOE has assembled the data in order to easily determine necessary actions. In order to evaluate the results of the sampling, the data collected for the IEMP will be presented and evaluated using the above formats. The findings of data evaluations will be shared with project personnel. The EPA and OEPA have identified that this is a successful method of evaluating and presenting the data.

Ultimately, the IEMP will be used to document the approach for determining when various modules can be removed from service, once remedial action objectives for the Great Miami Aquifer (provided in the Operable Unit 5 Record of Decision) are achieved. It is too early to begin the process of removing modules from the aquifer restoration system during 2001 and 2002. Therefore, methods for verifying remedy completion are not included in this IEMP. However, the IEMP will later serve as the vehicle for verifying the completion of the aquifer restoration. The sampling and data evaluation methods which will be used to verify restoration will be presented in future revisions of the IEMP.

3.7.2 Reporting

The IEMP groundwater program data will be reported in the form of a Data Extranet Site (the IEMP Data Information Site), quarterly summaries, and annual integrated site environmental reports. In addition, groundwater data that support the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring plan (DOE 1997c) will also be provided in the same manner. Additional information on IEMP data reporting is provided in Section 8.3.3.

Data pertaining to the groundwater program will be provided on an Extranet Site. The data will be in the format of searchable data sets and/or downloadable data files. This site will be updated every two to four weeks, as data become available.

The IEMP quarterly summary will supplement the Extranet Site by providing a brief summary of the data added to the site that quarter and identifying notable results and/or events related to that data. The IEMP quarterly summaries will be submitted within approximately 30 days from the end of the quarter.

The IEMP annual integrated site environmental reports will be issued each June for the previous year. The comprehensive report will discuss a year of IEMP data previously reported on the Extranet Site and in the quarterly summaries. The IEMP annual integrated site environmental reports will include the following:

Operational Assessment

- The "set point" pumping rate(s) for each extraction well during the year
- The "set point" re-injection rate(s) for each re-injection well and module during the year
- The uranium removal rate of individual wells
- Extraction and re-injection well total hours of operation during the year
- The volume of treated groundwater
- Extraction or re-injection well operating time expressed as a percentage of total available operating time
- The volume of water pumped from each extraction well during the year
- The volume of water re-injected into each re-injection well during the year
- The net water balance, based on the amount of water pumped and the amount of water re-injected during the last quarter
- Total pounds of uranium removed during the year
- Total pounds of uranium removed from the aquifer since the start of remediation
- The maximum, minimum, and average uranium concentration sent to treatment during the last year
- The monthly average uranium concentration in water discharged to the Great Miami River during the year
- Pumping rate figures for each extraction and re-injection well.

Aquifer Conditions

- The area of capture during the year
- A description of the geometry of the uranium plume during the year

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- The effect that restoration had (i.e., pumping) on the Paddys Run Road Site plume during the year
- The status of non-uranium FRL exceedances, including any newly detected FRL exceedances
- Identification of any new areas of FRL exceedances
- A comparison of groundwater restoration performance with respect to model predictions established in the Baseline Remedial Strategy Report
- Any changes that may have been made to the operation or design of the system to maintain the restoration on schedule as predicted in the Baseline Remedial Strategy Report.

Data that Support the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan

- Status information pertaining to the on-site disposal facility wells along with baseline data summaries
- Leachate volumes and concentrations from the leachate collection system and from the leak detection system for the on-site disposal facility
- Results of quarterly groundwater sampling initiated after waste is placed in a cell of the on-site disposal facility.

In addition, the IEMP annual integrated site environmental report will include trend analysis of the data collected from the on-site disposal facility.

Because the IEMP is a "living document", a structured schedule of annual reviews and two-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any groundwater program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

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Section 4.0

4.0 SURFACE WATER AND TREATED EFFLUENT MONITORING PROGRAM

Section 4.0 provides a description of the routine sitewide surface water and treated effluent monitoring to be performed during active remediation of the Fernald Environmental Management Project (FEMP), which includes the FEMP's numerous compliance-based monitoring and reporting obligations for surface water and treated effluent, and a media-specific plan for conducting all surface water and treated effluent monitoring activities.

4.1 INTEGRATION OBJECTIVES FOR SURFACE WATER AND TREATED EFFLUENT

Unlike groundwater and sediment, no direct restoration of the FEMP's surface water resources (i.e., Paddys Run and the Great Miami River) is required to achieve the surface water final remediation levels (FRLs) specified in the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b). However, because surface water represents both a contaminant transport pathway and a route of exposure for human and ecological receptors, routine monitoring of surface water is necessary to confirm that the FEMP's point and non-point discharges from other remedial operations to receiving waters fall within established thresholds. The monitoring activities for surface water will thus serve both a surveillance and a compliance function over the life of remediation at the FEMP. These measures will help document that the FEMP's remedial operations are protective of both groundwater (via the surface water cross-media pathway) and intended surface water uses in the vicinity of the FEMP.

The Integrated Environmental Monitoring Plan (IEMP) is the designated vehicle for conducting the FEMP's sitewide surface water surveillance and compliance monitoring downstream from project specific controls. The IEMP's focus is to accommodate remedial construction and operation activities taking place in 2001 and 2002. Ultimately, the IEMP will be used to verify and document that the conclusion of the FEMP's sitewide remedial actions result in a condition that no longer poses any long-term threat to human health and/or the environment through the surface water pathway. In this comprehensive role, the IEMP serves to integrate several compliance-based monitoring and reporting programs currently in existence for the FEMP:

- The discharge monitoring and reporting program related to the site National Pollutant Discharge Elimination System (NPDES) Permit
- The radiological monitoring of and reporting for the treated effluent mandated by the Federal Facilities Compliance Agreement (FFCA) and Operable Unit 5 Record of Decision

- The IEMP Characterization Program which combines portions of the former Environmental Monitoring Program (EMP) that has been ongoing at the FEMP since the 1950s and was updated in the IEMP, Revision 0 (DOE 1997b), to accommodate surface water monitoring needs during remediation.

As discussed in Section 4.6, these multiple programs have been brought together under a single reporting structure to facilitate review of the performance of the FEMP's surface water protection actions and measures.

4.2 ANALYSIS OF REGULATORY DRIVERS, DOE ORDERS, AND OTHER FEMP-SPECIFIC AGREEMENTS

This section presents a summary evaluation of the regulatory drivers governing the monitoring of the FEMP's point and non-point discharges to Paddys Run and the Great Miami River. The intent of this section is to identify the pertinent regulatory requirements, including applicable or relevant and appropriate requirements (ARARs) and to be considered-based requirements, for the scope and design of the surface water monitoring program. These requirements will be used to confirm that the program satisfies the regulatory obligations for monitoring that have been activated by the FEMP's record of decisions and will achieve the intentions of other pertinent criteria, such as U.S. Department of Energy (DOE) Orders and the FEMP's existing agreements and permits, as appropriate that have a bearing on the scope of surface water and treated effluent monitoring.

The results of the analysis will also be used to define, as appropriate for this media, the administrative boundaries between the IEMP and the project-specific emission control and uncontrolled runoff monitoring conducted by other FEMP organizations.

4.2.1 Approach

The analysis of the regulatory drivers and policies for surface water and treated effluent was conducted by examining the suite of ARARs and to be considered-based requirements in the Operable Unit 5 Record of Decision to identify the subset with specific environmental monitoring requirements. The FEMP's existing compliance agreements issued outside the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process (such as the NPDES Permit requirements and the FFCA) were also reviewed.

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4.2.2 Results

The following summary of regulatory drivers, compliance agreements, and DOE Orders were found to govern the monitoring scope and reporting requirements for surface water and treated effluent:

- CERCLA Record of Decision for Remedial Actions at Operable Unit 5, which requires remediation of the site such that the surface water pathway is protective of the underlying Great Miami Aquifer and various surface water environmental receptors. The surface water FRLs provided in the Operable Unit 5 Record of Decision considered and incorporated all chemical-specific ARARs and to be considered-based requirements for the protection of human health via the surface water pathway.

- The CERCLA Feasibility Study Report for Operable Unit 5 (DOE 1995b), which stated that if the concentrations of constituents remain above benchmark toxicity values (BTVs) after completion of the remedial action, then further investigation and remediation may be warranted. The surface water BTVs listed in this report were identified as contaminant concentrations that are protective of ecological receptors. The list of constituents was further refined based on the ecological risk screening process presented in the Sitewide Excavation Plan (DOE 1998b); this information is summarized in Section 4.4.2.1.

- The current NPDES Permit for the FEMP, which triggers a variety of site-specific surface water and treated effluent sampling, analysis, and reporting requirements (as specified in Ohio Administrative Code 3745-33) for non-radiological discharges.

- The 1986 FFCA, which requires that the FEMP maintain a continuous sample collection program for radiological constituents at the FEMP's treated effluent discharge points and report the results quarterly to the U.S. Environmental Protection Agency (EPA), Ohio Environmental Protection Agency (OEPA), and the Ohio Department of Health. The sampling program to address this requirement has been modified over the years and is currently governed by an agreement reached with EPA and OEPA in early 1996 as described in the letter "Phase VII Removal Actions and Reporting Requirements Under the Fernald Environmental Management Project Legal Agreements" from DOE to EPA (DOE 1996a). This agreement became effective May 1, 1996. This agreement requires sampling at the Parshall Flume (PF 4001), the Storm Water Retention Basin spillway (SWRB 4002O), and the Storm Water Retention bypasses (SWRB 4002B) for radiological constituents. With approval of the IEMP, Revision 0, in 1997, the sampling program was modified to better assess the impact of the site on the surface water pathway. These details are provided in Section 4.4.2.8.

- DOE Order 5400.1, General Environmental Protection Program Requirements, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine treated effluent monitoring and environmental surveillance activities of the facility. The FEMP's EMP provided the initial basis for the development of the IEMP strategy that is responsive to the changing site mission and associated remedial needs while still DOE Order compliant.

- DOE Order 5400.5, Radiation Protection of the Public and the Environment, which obligates the FEMP to perform surveillance monitoring of surface water to ensure that radiological dose limits to the public in the DOE Order are not exceeded. Under these requirements, the exposure to members of the public associated with activities at DOE facilities from all pathways must not exceed, in one year, an effective dose equivalent greater than 100 millirem. Studies in support of the Operable Unit 5 Feasibility Study demonstrated for all media that combined exposure to FEMP radiological constituents of concern at their respective FRLs fall well below the DOE dose requirement. Therefore, monitoring designed to track and document the CERCLA FRL-based remediation of the site meets the intent of DOE Order 5400.5.

The single project-specific surface water monitoring driver is the Storm Water Pollution Prevention Plan, submitted under the NPDES Permit. This plan requires engineering controls to protect downgradient areas during construction and excavation activities conducted outside controlled runoff areas. Maintenance and monitoring will be conducted by the individual projects, as necessary, to determine whether runoff from the installed project control structures presents an unacceptable impact to surface water. Any necessary project-specific monitoring is determined during preparation and review of the individual remedial design packages.

The surface water and treated effluent monitoring program described in this IEMP has been developed with full consideration of these regulatory drivers. Table 4-1 lists each of these IEMP and project-specific drivers and the associated monitoring conducted to comply with them. Sections 4.6 and 8.0 provide the FEMP's current and long-range plan for complying with the reporting requirements invoked by these drivers.

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TABLE 4-1

FEMP SURFACE WATER AND TREATED EFFLUENT MONITORING REGULATORY DRIVERS AND RESPONSIBILITIES

	DRIVER	ACTION
IEMP	DOE Order 5400.1, Environmental Monitoring Plan for all media	The IEMP describes treated effluent and surveillance monitoring as required by DOE Order 5400.1.
	DOE Order 5400.5, Radiation Protection of Public and Environment	The IEMP includes a description for routine sampling of Paddys Run and on-site drainage ditches for radionuclides.
	Operable Unit 5 Record of Decision	The IEMP will be modified toward completion of the remedial action to include sampling to certify FRL achievement.
	Operable Unit 5 Feasibility Study	The IEMP will be modified toward completion of the remedial action to include verification sampling for BTV constituents. The IEMP has modified its BTV constituent sampling list to account for potential impacts to surface water during excavation and remediation as assessed and revised in the Sitewide Excavation Plan.
	NPDES Permit	The IEMP describes routine sampling of permit-designated effluent discharges and storm water drainage points for NPDES Permit constituents.
	Federal Facilities Compliance Agreement Radiological Monitoring	The IEMP describes the routine sampling at the Parshall Flume (PF 4001), Storm Water Retention Basin spillway (SWRB 4002O), and Storm Water Retention Basin bypass (SWRB 4002B) for radiological constituents.
	DOE Order 5400.1, Environmental Monitoring Plan for all media	The IEMP describes treated effluent and surveillance monitoring as required by DOE Order 5400.1.

	DRIVER	ACTION	PROJECT PLAN
PROJECT	Storm Water Pollution Prevention Plan	Routine sampling of project-specific sediment traps and basins	Project-specific monitoring via integrated remedial design packages

4.3 PROGRAMMATIC BOUNDARY FOR THE SURFACE WATER AND TREATED EFFLUENT MONITORING PROGRAM

This section identifies the programmatic boundaries established between the IEMP and the project-specific activities to be conducted by others. The intent behind the boundary definition is to: 1) clearly delineate the scope and geographic extent of the IEMP's monitoring responsibility; and 2) establish a recognized interface between the sitewide focus of the IEMP and the predominant emission-control focus of project-specific monitoring.

It is important to emphasize that the IEMP program boundary for each of the FEMP's environmental media is unique and, for portions of the surface water and treated effluent program, time dependent. The boundary is the combined result of:

- Regulatory monitoring requirements
- The physical configuration of the site, planned remediation areas (which will change over time) for soil excavation and certification occurring in various areas of the site shown in Figure 4-1, and the associated project specific controls/monitoring of uncontrolled runoff
- The treated effluent monitoring responsibilities assigned to the IEMP.

For surface water, the programmatic boundary requiring definition for purposes of the IEMP is the line of demarcation between the areas where surface water remains uncontrolled and where surface water is currently controlled (former production area, Operable Unit 3; waste storage areas, Operable Units 1 and 4; Cells 1, 2, and 3 of the on-site disposal facility; and the southern waste units in Operable Unit 2 as shown in Figure 4-2), or will be controlled as a result of soil remediation activities and further construction of the on-site disposal facility. As noted above, these boundaries will be transient during remediation as the soil remediation progresses across the site and as additional cells of the on-site disposal facility are developed. In essence, the IEMP will provide surveillance monitoring downstream from the areas where project-specific controls are in place. IEMP surface water and treated effluent monitoring also includes all FFCA and NPDES surface water and treated effluent sampling requirements.

To assist in interpretation of IEMP surface water and treated effluent data collected downstream from the project-specific controls, the IEMP reports will: 1) present contaminant releases attributable to remediation; 2) state whether such releases remain within the established limits; and 3) notify the associated project personnel that such releases have occurred. Section 4.6 discusses this further.

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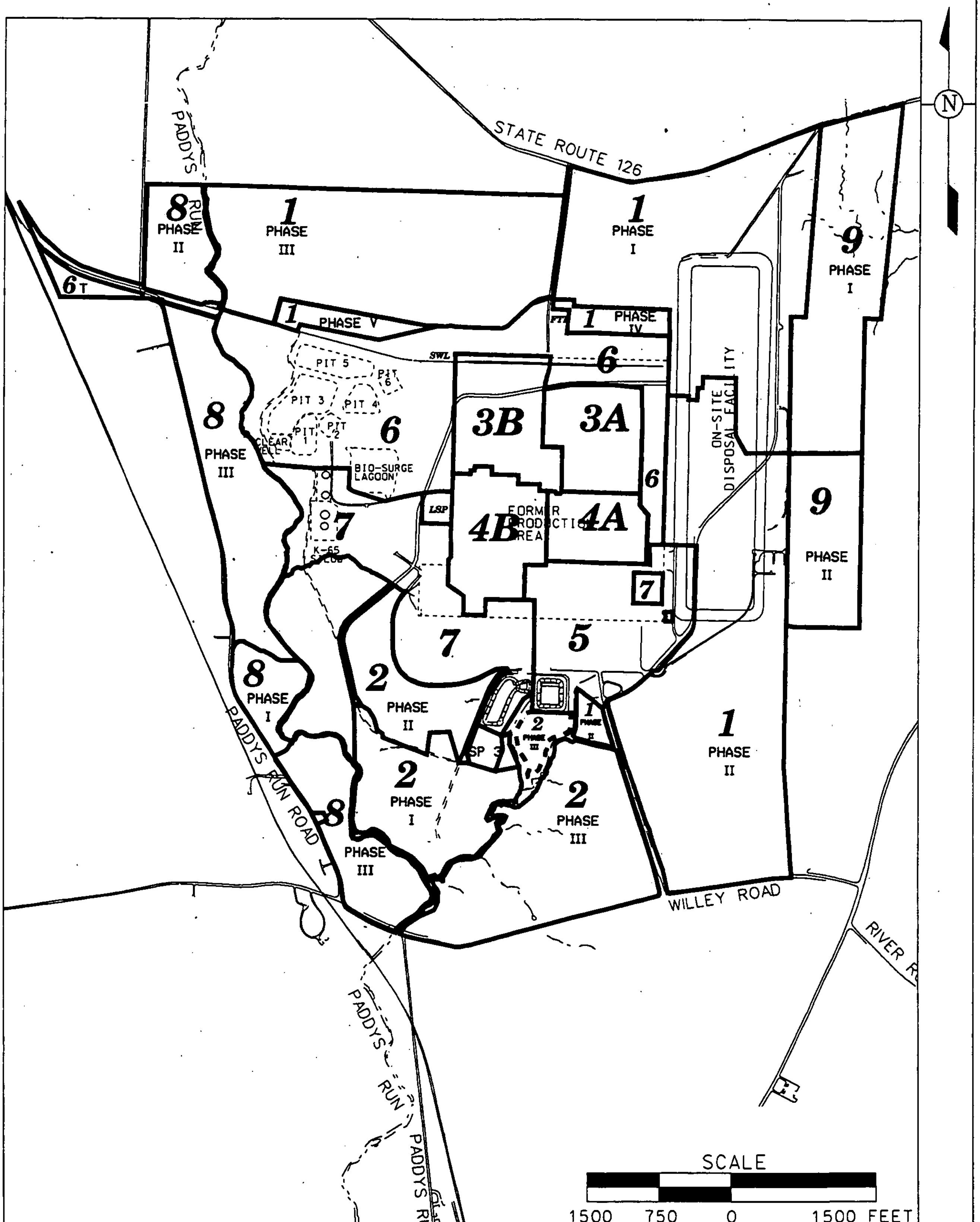
STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000



LEGEND:

— · — · —	FEMP BOUNDARY
1	REMEDIATION AREA
- - - - -	PHASE BOUNDARIES
———	REMEDIATION AREA BOUNDARIES

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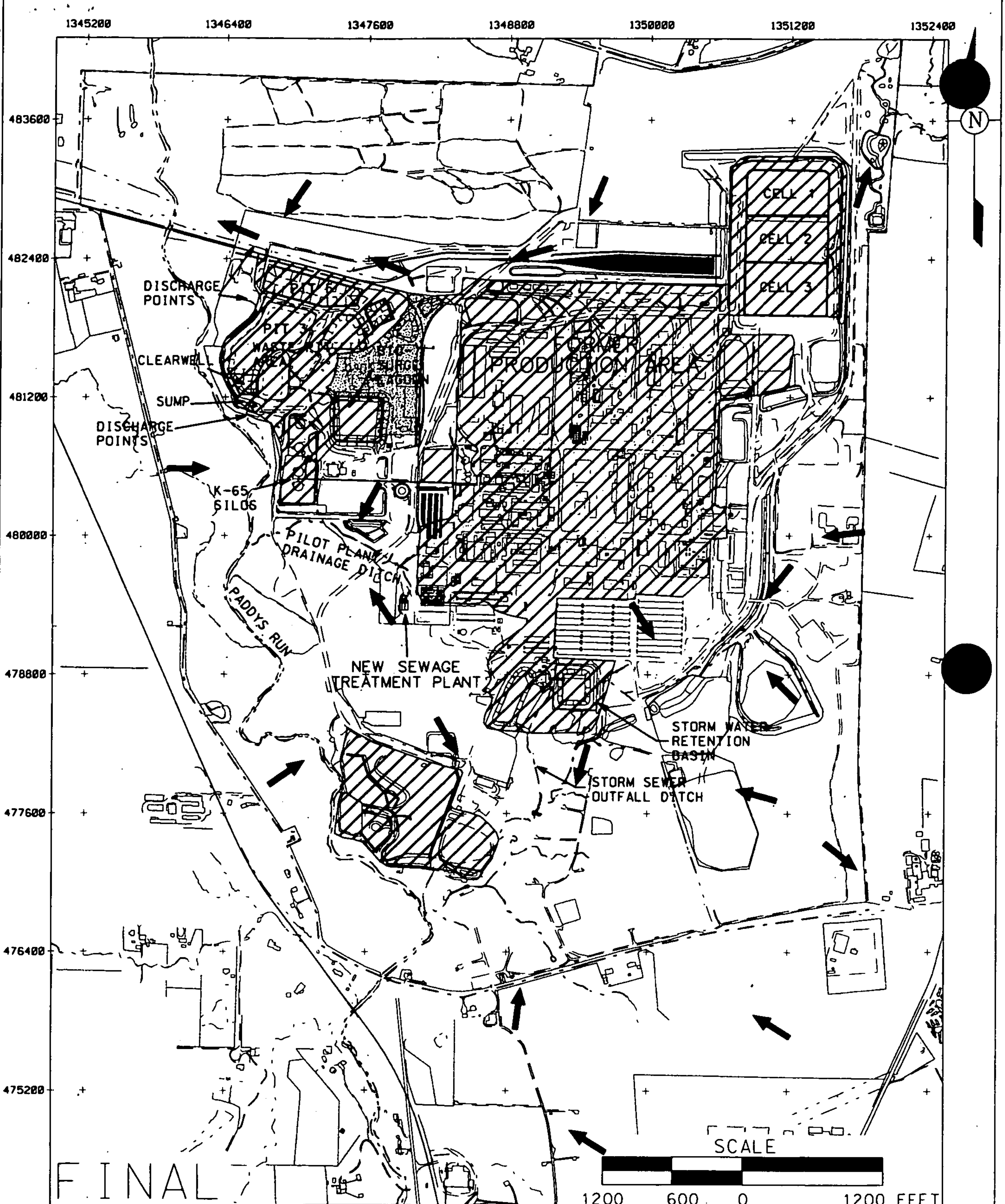
FINAL

FIGURE 4-1. SITEWIDE REMEDIATION AREAS

V:/5FGP1/DGN/OOREVISION/OORVO23.DGN

STATE PLANAR COORDINATE SYSTEM 1983

11-24-99



LEGEND:

- — - — FEMP BOUNDARY
- CONTROLLED AREA
- UNCONTROLLED RUNOFF FLOW DIRECTION
- WATER TREATED IF TOTAL URANIUM RESULT IS >20 $\mu g/L$

NOTE: CONTROLLED MEANS WATER IS COLLECTED AND SENT FOR TREATMENT AT THE AWWT

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FIGURE 4-2. ANTICIPATED CONTROLLED RUNOFF AREAS AND UNCONTROLLED FLOW DIRECTIONS AS OF JANUARY 1, 2001

4.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

4.4.1 Program Expectations

The IEMP surface water and treated effluent monitoring program is being designed to collect data sufficient to meet the following expectations for 2001 and 2002:

- Provide an ongoing assessment of the potential for cross-media impacts from surface water to the underlying Great Miami Aquifer at locations near the point where the protective glacial overburden has been breached by site drainages
- Document whether the sporadic exceedances of FRLs and BTVs in various site drainages (noted in the Operable Unit 5 Feasibility Study) continue to occur at key on-property locations, at the property boundary on Paddys Run, and in the Great Miami River outside the mixing zone
- Provide an assessment of impacts to surface water due to uncontrolled runoff and implementation of FEMP remediation activities
- Provide data to determine if certain constituents exceed the FRL. This is necessary for some constituents because either there were insufficient historical analyses, or historical analyses' detection limits exceeded the FRL
- Provide additional data at background locations on Paddys Run and the Great Miami River to refine the FEMP's ability to distinguish site impacts from background as remediation progresses
- Continue to fulfill monitoring and reporting requirements associated with the site NPDES Permit
- Continue to fulfill monitoring and reporting requirements associated with the FFCA and Operable Unit 5 Record of Decision
- Continue to fulfill DOE Order 5400.1 requirements to maintain an environmental monitoring plan for surface water
- Continue to address the concerns of the community regarding the magnitude of the FEMP's discharges to surface water (i.e., to Paddys Run and the Great Miami River).

The following section provides the design considerations required to fulfill each of these expectations.

4.4.2 Design Considerations

4.4.2.1 Constituent Selection Criteria

A comprehensive summary of site-specific information and data was assembled to determine the most appropriate site-specific indicator constituents for surface water and treated effluent sampling under the IEMP; Table 4-2 presents this information. The following is a description of each of the columns in Table 4-2 and how the information in the table was used to determine the most appropriate constituents for a particular location. Note that the information provided in Table 4-2 was utilized to select constituents at key locations identified in Sections 4.4.2.2 through 4.4.2.5 and was not applied to some of the NPDES Permit sample locations because the permit sampling requirements control sampling activities at the NPDES locations.

- Column 1, Constituent: This column represents the suite of constituents considered for monitoring in the surface water pathway as a result of the remedial investigation/feasibility study process at the FEMP. It represents the constituents for which a FRL was established in the Operable Unit 5 Record of Decision.

- Column 2, Final Remediation Levels: This column represents the human-health-protective remediation levels for surface water that were established in the Operable Unit 5 Record of Decision.

- Column 3, FRL Basis: This column is the basis for establishment of the FRL as defined in the Operable Unit 5 Feasibility Study.

  This information was used as part of the constituent selection process for each of the proposed IEMP surface water sample locations. If a constituent failed the modeling in any drainage area upstream of a particular sample location, then the respective downstream sample location target analyte list includes the failed constituent.

- Column 4, 95th Percentile Background Level in Surface Water: This column represents the 95th percentile background level in surface water as presented in the Remedial Investigation Report for Operable Unit 5 (DOE 1995d) for Paddys Run and the Great Miami River. The IEMP provides this information for purposes of comparison.

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TABLE 4-2

SURFACE WATER SELECTION CRITERIA SUMMARY

Constituent[a]	FRL[b]	FRL Basis[b]	95th Percentile Background Level in Surface Water[c,d]	
			Paddys Run	Great Miami River
General Chemistry (mg/L)				
Fluoride	2.0	A	0.22	0.9
Nitrate/Nitrite	2400	R	1.7	6.6
Inorganics (mg/L)				
Antimony	0.19	A	ND	ND
Arsenic	0.049	R	ND	0.0036
Barium[e]	100	R	0.053	0.1
Beryllium	0.0012	A	ND	ND
Cadmium[e]	0.0098	B	ND	0.01
Chromium VI[f]	0.010	D	ND	ND
Copper	0.012	A	ND	0.012
Cyanide	0.012	A	ND	0.005
Lead	0.010	B	ND	0.010
Manganese	1.5	R	0.035	0.08
Mercury	0.00020	D	ND	ND
Molybdenum	1.5	R	ND	0.02
Nickel	0.17	A	ND	0.023
Selenium	0.0050	A	ND	ND
Silver[e]	0.0050	D	ND	ND
Vanadium	3.1	R	ND	ND
Zinc	0.11	A	ND	0.045

TABLE 4-2
(Continued)

Constituent[a]	FRL[b]	FRL Basis[b]	95th Percentile Background Level in Surface Water[c,d]	
			Paddys Run	Great Miami River
Semi-Volatiles (µg/L) (Contd.)				
3,3'-Dichlorobenzidine	7.7	R	-	-
Di-n-butylphthalate	6000	R	-	-
Di-n-octylphthalate	5.0	D	-	-
p-Methylphenol	2200	R	-	-
4-Nitrophenol	7,400,000	R	-	-
Volatiles (µg/L)	280	R	-	-
Benzene	280	R	-	-
Bromodichloromethane	240	R	-	-
Bromomethane	1300	R	-	-
Chloroform	79	A	-	-
1,1-Dichloroethene	15	R	-	-
Methylene chloride	430	A	-	-
Tetrachloroethene	45	R	-	-
1,1,1-Tricholoroethane	1.0	D	-	-
1,1,2-Tricholoroethane	230	R	-	-

[a]Highlighting indicates constituents selected for IEMP surface water analysis at locations other than background and NPDES Permit sample locations.
[b]Derived from Operable Unit 5 Record of Decision, Table 9-5
A = ARAR values
B = Background concentrations
D = Analytical detection limit
R = Human health risk
[c]ND = non-detected result
- = not applicable/not available
[d]For small data sets (less than or equal to seven samples), the maximum detected concentration is used as the 95th percentile.
[e]BTVs apply only to barium, cadmium, silver. Barium BTV (0.145 mg/L) was exceeded seven times. Cadmium BTV (0.0035 mg/L) was exceeded 21 times. Silver BTV (0.0013 mg/L) was exceeded 23 times.
[f]FRL based on chromium VI; however, the analytical results are for total chromium.

TABLE 4-2
(Continued)

Constituent[a]	FRL[b]	FRL Basis[b]	95th Percentile Background Level in Surface Water[c,d]	
			Paddys Run	Great Miami River
Semi-Volatiles (μg/L) (Contd.)				
3,3'-Dichlorobenzidine	7.7	R	-	-
Di-n-butylphthalate	6000	R	-	-
Di-n-octylphthalate	5.0	D	-	-
p-Methylphenol	2200	R	-	-
4-Nitrophenol	7,400,000	R	-	-
Volatiles (μg/L)	280	R	-	-
Benzene	280	R	-	-
Bromodichloromethane	240	R	-	-
Bromomethane	1300	R	-	-
Chloroform	79	A	-	-
1,1-Dichloroethene	15	R	-	-
Methylene chloride	430	A	-	-
Tetrachloroethene	45	R	-	-
1,1,1-Tricholoroethane	1.0	D	-	-
1,1,2-Tricholoroethane	230	R	-	-

[a]Highlighting indicates constituents selected for IEMP surface water analysis at locations other than background and NPDES Permit sample locations.
[b]Derived from Operable Unit 5 Record of Decision, Table 9-5
A = ARAR values
B = Background concentrations
D = Analytical detection limit
R = Human health risk
[c]ND = non-detected result
- = not applicable/not available
[d]For small data sets (less than or equal to seven samples), the maximum detected concentration is used as the 95th percentile.
[e]BTVs apply only to barium, cadmium, silver. Barium BTV (0.145 mg/L) was exceeded seven times. Cadmium BTV (0.0035 mg/L) was exceeded 21 times. Silver BTV (0.0013 mg/L) was exceeded 23 times.
[f]FRL based on chromium VI; however, the analytical results are for total chromium.

Surface water BTVs from the Sitewide Ecological Risk Assessment (as documented in the Operable Unit 5 Feasibility Study) are used to predict the toxicity of chemicals to ecological receptors. Based on the results of the BTV screening process presented in the approved Sitewide Excavation Plan, three constituents (barium, cadmium, and silver) will continue to be evaluated against BTVs as identified in Table 4-2. A constituent was added to the list for all surface water and treated effluent sample locations downstream of the BTV exceedance. Appendix B provides maps illustrating the locations of the historical BTV exceedances for the three constituents.

4.4.2.2 Surface Water Cross-Media Impact

To assess the cross-media impact that contaminated surface water has on the underlying Great Miami Aquifer, the following design considerations are necessary:

- Samples should be collected at those points near where the glacial overburden has been breached by site drainages. As described in the Operable Unit 5 Remedial Investigation, the majority of the FEMP is underlain by clay-rich glacial overburden. Where present, this glacial overburden provides a measure of protection to the underlying sand-and-gravel aquifer. However, the glacial overburden (Figure 4-3) has been eroded by site drainages primarily in the lower reaches of Paddys Run and in the Storm Sewer Outfall Ditch. Additionally, pre-design groundwater characterization activities in the waste storage and Plant 6 areas confirmed that an area in the Pilot Plant Drainage Ditch adjacent to Paddys Run should be considered as a primary source of infiltration. At these locations, a direct pathway exists for surface water and associated contaminants to reach the underlying sand-and-gravel Great Miami Aquifer. The Operable Unit 5 Remedial Investigation concluded that contaminant migration via this pathway created the South Plume. Specifically, the South Plume formed over the years when contaminated surface water infiltrated through the streambeds of the Storm Sewer Outfall Ditch and Paddys Run.

- Constituents analyzed should represent those area-specific constituents of concern identified in the Operable Unit 5 Feasibility Study and subsequent fate-and-transport modeling as having the potential for cross-media impact to groundwater via the surface water pathway.

- Sampling frequency should be such that seasonal fluctuations in contaminant concentrations (as well as fluctuations due to varying flow conditions) can be assessed.

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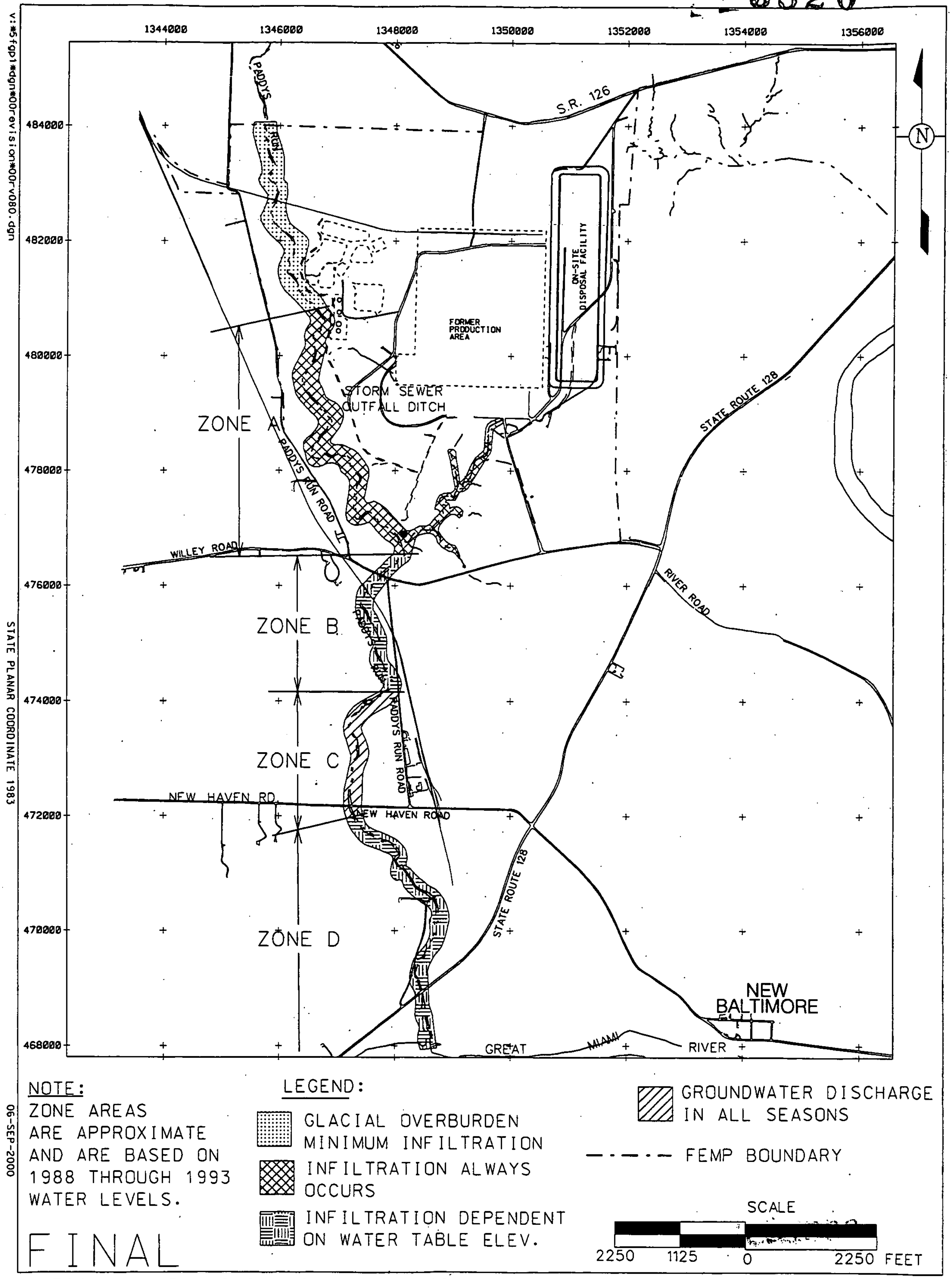

FIGURE 4-3. SURFACE WATER INFILTRATION TO THE GREAT MIAMI AQUIFER ALONG PADDYS RUN AND THE STORM SEWER OUTFALL DITCH

4.4.2.3 Sporadic Exceedances of FRLs and BTVs

To assist in the development of the scope and focus of the IEMP surface water and treated effluent program, a review of the FEMP's sitewide surface water characterization database was conducted. This review identified a limited number of constituents that occasionally and sporadically exceeded their respective FRL or BTV established through the Operable Unit 5 remedial investigation/feasibility study process. Appendix B provides maps detailing surface water locations with FRL or BTV exceedances. To comply with the requirements of the Operable Unit 5 Record of Decision, all surface water FRLs must be achieved and maintained at the completion of the FEMP's remedial actions. (The Operable Unit 5 Feasibility Study acknowledged that BTVs were not a formal part of the FRL development process.) To address the BTVs, the Operable Unit 5 Feasibility Study provided a provision that, if following remediation of the site to achieve FRLs, the concentrations of constituents remained above BTVs for ecological receptors, further investigation and remediation may be warranted. The plan for accommodating the BTVs, as established in the Operable Unit 5 Feasibility Study, is therefore a necessary design consideration for development of the surface water monitoring plan under the IEMP. Surface water BTV constituents were evaluated in the Sitewide Excavation Plan to determine the applicability of the BTVs to surface water at the FEMP. This screening process concluded that barium, cadmium, and silver should continue to be evaluated against surface water BTVs.

During remediation, those constituents that have occasionally exceeded FRLs and/or BTVs should be monitored to document whether the exceedances continue to occur, or, as expected, dissipate as remediation progresses. Because active remediation will be occurring in and near on-property drainages, it is appropriate to monitor for exceedances of the FRLs and BTVs downstream from the remediation areas and upstream from the off-property receptors. Therefore, sample locations should be located at: 1) on-property locations downstream of historical FRL or BTV exceedances; 2) the point where Paddys Run flows off the FEMP property; 3) the northeast drainage as it leaves the property; and 4) the Parshall Flume (PF 4001), where treated effluent is discharged from the FEMP to the Great Miami River. To determine the concentration of the treated effluent constituents outside the mixing zone in the Great Miami River, a conservative calculation using the 10-year low-flow conditions is necessary requiring that flow conditions at the Hamilton Dam gauge to be periodically reviewed. The new NPDES Permit (1IO00004*FD) includes outfall sample location SWR-4902, which is located downstream of the Parshall Flume discharge. Sample location SWR-4902 will be used to supplement this evaluation. To provide surveillance monitoring for FRL and BTV exceedances, samples will be collected quarterly and analyzed for those constituents identified in Table 4-2 as having exceeded FRLs or BTVs within the

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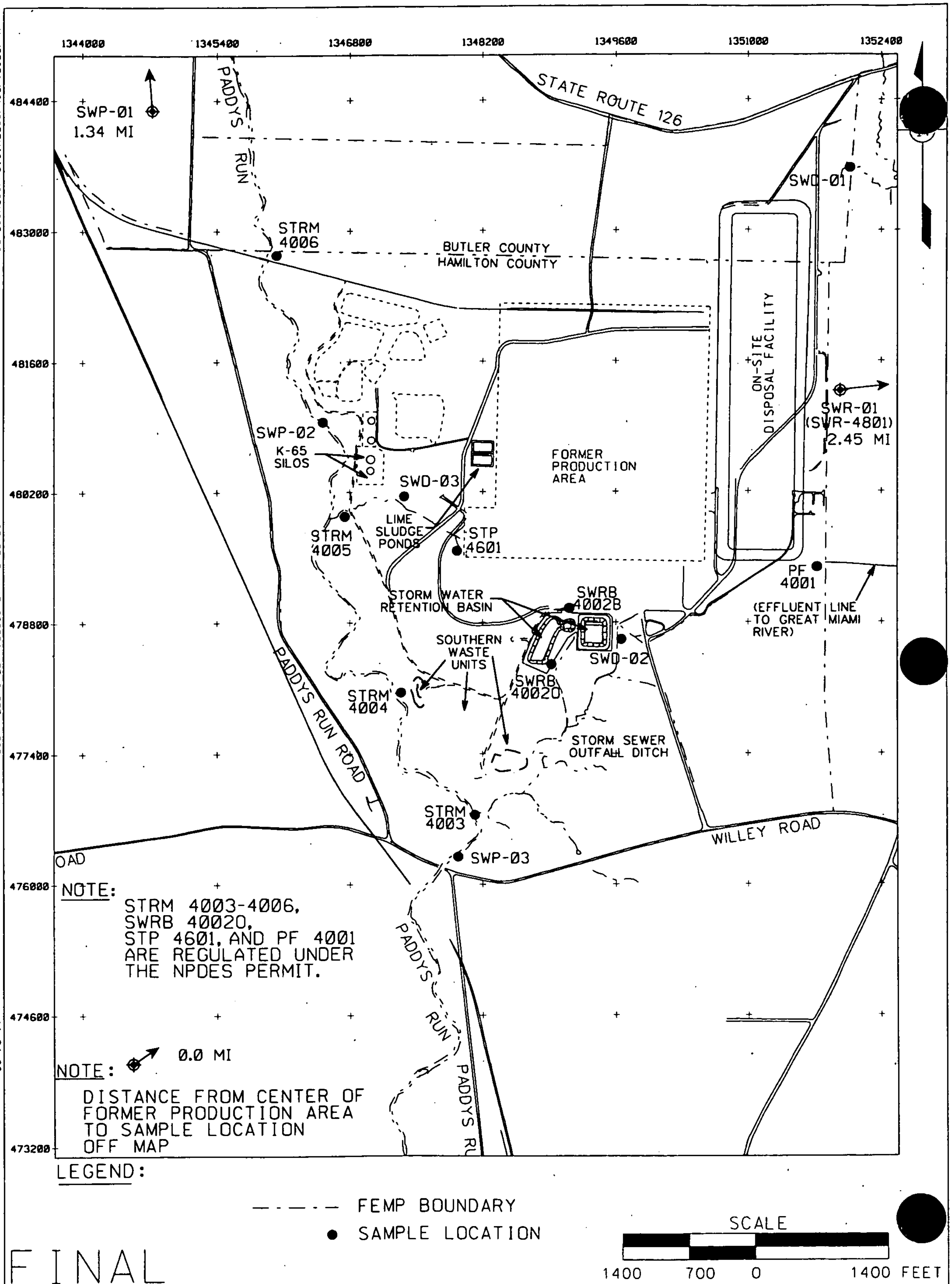
respective drainage areas upstream of the sample location. The quarterly sampling should be conducted such that contaminant concentrations under a range of flow conditions are assessed.

4.4.2.4 Impacts to Surface Water due to Uncontrolled Storm Water Runoff and Remediation Activities

As stated in Section 4.3, IEMP surface water monitoring will occur outside of and downstream from areas where storm water is controlled. Figure 4-2 shows that the majority of highly contaminated storm water drainage from the site (i.e., from the former production area [Operable Unit 3], the waste storage area [Operable Units 1 and 4], portions of Operable Unit 2 [inactive flyash pile/South Field], and active cells at the on-site disposal facility) has been identified and controlled through contaminant abatement, formal removal actions, and remediation activities.

During 1997 and 1998 numerous engineered controls were installed to protect surface water drainages downgradient of remediation activities. Several basins were installed at various locations around the FEMP including the northeastern portion of the FEMP, southeast of the silos, east of the waste storage area, west of the new north railyard, and in the on-site disposal facility borrow area. Construction of a series of diversion ditches and sedimentation basins has been completed to provide storm water control during remediation of the southern waste units. In addition, operation of the relocated sewage treatment plant began on May 23, 1998.

Several large-scale field activities planned for 2001 and 2002 that could potentially affect the surface water pathway include, waste excavation, waste treatment and waste shipment in the waste storage area, continued soil excavations, continued waste placement activities into the on-site disposal facility, and construction activities associated with the Operable Unit 4 Accelerated Waste Retrieval and Silo 3 Stabilization Projects. (Additional information concerning site remedial activities is contained in Section 2.0.) To identify any potential impact from uncontrolled runoff originating in the area between the waste storage area and the former production area, uncontrolled runoff will be monitored monthly for total uranium at SWD-03 (Figure 4-4). In addition, because total uranium is the primary constituent of concern at the FEMP, total uranium will be monitored quarterly at a minimum at each of the IEMP sample locations to assist in determining the site's impact on the surface water pathway.



STATE PLANAR COORDINATE SYSTEM 1983

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FIGURE 4-4. IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

Figure 4-5 shows the dramatic effect storm water runoff controls have had in lowering the concentrations of uranium, the principal site contaminant, in surface water leaving the site via Paddys Run. Other important distinctions regarding uranium in uncontrolled runoff from the site to Paddys Run, based on the data in Figure 4-5, are that:

- Average concentrations have been far below the human-health-protective surface water FRL concentration of 530 micrograms per liter (µg/L) in each year since 1981. (This includes nine years while the site was in production.)
- Annual average concentrations consistently have been below the human-health-protective groundwater FRL of 20 µg/L since the Storm Water Retention Basin began collecting contaminated runoff in 1986.

Storm water runoff controls currently in place are anticipated to remain until remediation of each respective area is complete. Therefore, it will not be necessary to monitor within these controlled areas for purposes of the IEMP because runoff from these areas is collected and treated. Monitoring of the resultant treated effluent is covered by the NPDES, FFCA, and Operable Unit 5 Record of Decision programs as discussed in Sections 4.4.2.7 and 4.4.2.8.

Additional controls for storm water runoff are mandated by the Storm Water Pollution Prevention Plan for construction activities. As Section 4.3 notes, responsibility for construction and maintenance of storm water runoff controls and monitoring the effectiveness of such controls is the responsibility of each individual project. The specifications of these storm water runoff controls and associated performance monitoring of the storm water runoff controls will be detailed in Operable Unit 5 soil remediation remedial action work plans and other project-specific remedial action documentation, as warranted.

Effective sampling points for this surveillance monitoring need to be:

- At points downstream of the storm water runoff controls and construction/remediation activities
- At the FEMP boundary in Paddys Run
- In the treated effluent routed to the Great Miami River as it leaves the facility
- At the Storm Water Retention Basin spillway, during overflow conditions.

Note: The surface water FRL for total uranium is 530 μg/L.

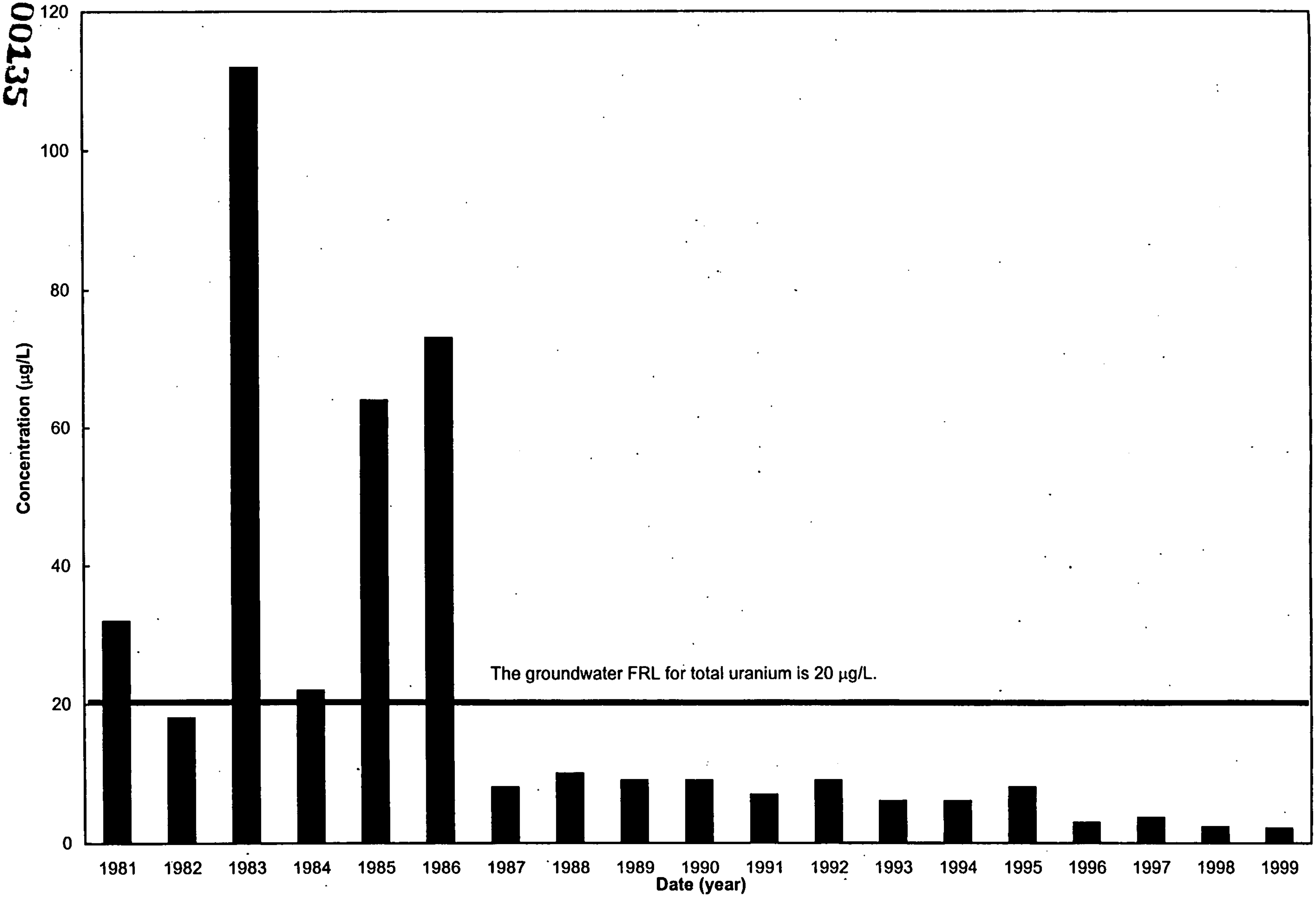

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FIGURE 4-5. COMPARISON OF AVERAGE TOTAL URANIUM CONCENTRATIONS AT PADDYS RUN AT WILLEY ROAD SAMPLE LOCATION SWP-03

Parameters for this surveillance monitoring need to be those constituents that:

- Exceed surface water FRLs or BTVs upstream from the sample locations
- Are present in sufficient concentration upstream of the sample locations and are mobile to the degree such that they have the potential to: 1) cause cross-media impacts to groundwater; 2) affect surface water to the degree that human-health-protective FRLs are exceeded; and 3) impact surface water above BTVs.

The frequency of sampling to fulfill this expectation should be such that seasonal variations in contaminant concentrations (as well as fluctuations due to varying flow conditions) can be assessed quarterly. To adequately assess the impact of storm water overflows from areas where storm water is controlled, the frequency of sampling at the Storm Water Retention Basin shall be such that each overflow is characterized.

4.4.2.5 Insufficient Number of Historical Analyses

Due to insufficient data for a limited number of constituents with FRLs (i.e., method detection limits for most analyses were above the FRL or there were an insufficient number of analyses), it cannot be adequately determined whether analytical results for such constituents exceed the FRLs and/or BTVs. These constituents include benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, and 3,3'-dichlorobenzidine. FRLs and BTVs were developed after sampling in support of the remedial investigation was completed. FRLs developed for several constituents were based on the lowest reasonable and achievable method detection limits. For several constituents, the resulting FRLs were below the method detection limits used for the samples collected during the remedial investigation. Samples collected after implementation of the IEMP have successfully met the required low method detection limits. Additionally, lead-210 has not been sampled historically in surface water at the FEMP.

Therefore, to adequately assess whether these constituents are a concern, effective sample locations need to be:

- At the FEMP boundary in Paddys Run
- In the treated effluent routed to the Great Miami River as it leaves the facility
- The frequency of sampling to fulfill this expectation should be such that seasonal variations in contaminant concentrations (as well as fluctuations due to varying flow conditions) can be assessed.

4.4.2.6 Ongoing Background Evaluation

As shown in the Operable Unit 5 Remedial Investigation, the remedial investigation/feasibility study background data set for Paddys Run and the Great Miami River surface water was limited both by the number of samples and temporal variability represented by the samples. In addition to this remedial investigation/feasibility study data limitation, background surface water quality is by nature transient (i.e., background surface water quality is subject to variations over time due to changes in activities and runoff conditions within the watershed). To address the limited background data for Paddys Run and the Great Miami River, the following considerations are recommended to maintain the IEMP surface water background sampling program:

- Sample locations (SWP-01 and SWR-01 [NPDES sample location SWR-4801]), shown in Figure 4-6, shall be consistent with those locations established for the former EMP and the remedial investigation/feasibility study.

- Constituents analyzed shall represent the constituents for which the Operable Unit 5 Record of Decision established surface water FRLs.

- Sampling frequency shall be such that seasonal variations (as well as variations due to varying flow conditions) can be assessed.

These considerations define the IEMP program for surface water sampling of background locations, which is provided in the following program design section.

4.4.2.7 Continue to Fulfill National Pollutant Discharge Elimination System Requirements

As noted in Section 4.2, wastewater and storm water discharges from the FEMP are regulated under the state-administered NPDES program. The current permit (OEPA Permit 1I000004*FD) was issued on January 28, 2000, became effective on March 1, 2000, and expires on October 31, 2002. All surface water and treated effluent sampling and analysis requirements as they are defined in the current permit or any future renewed or modified permit will be carried forward and integrated in the IEMP as discussed in Section 4.4.3. Figure 4-7 identifies the NPDES Permit sample locations.

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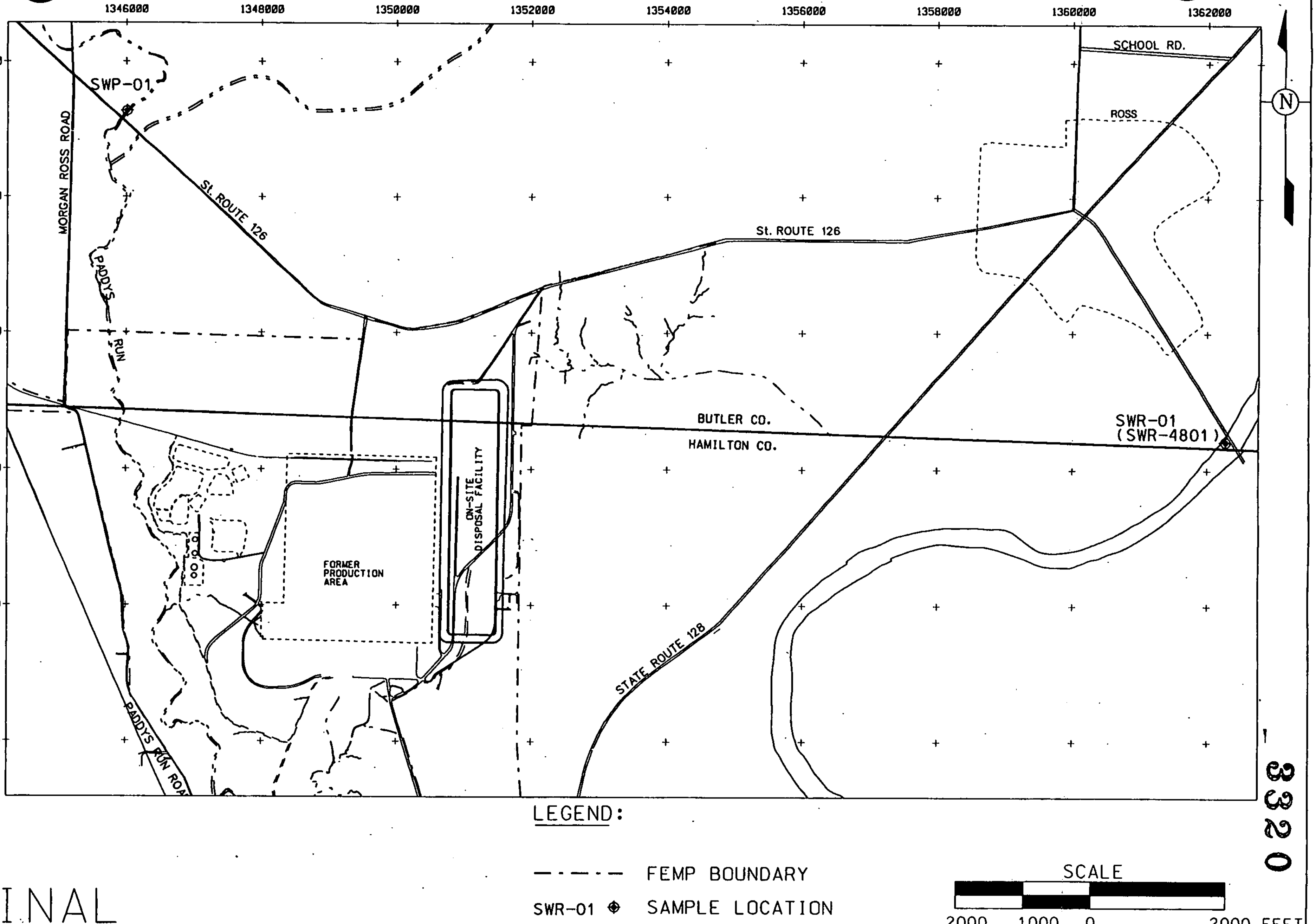

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FIGURE 4-6. IEMP BACKGROUND SURFACE WATER SAMPLE LOCATIONS

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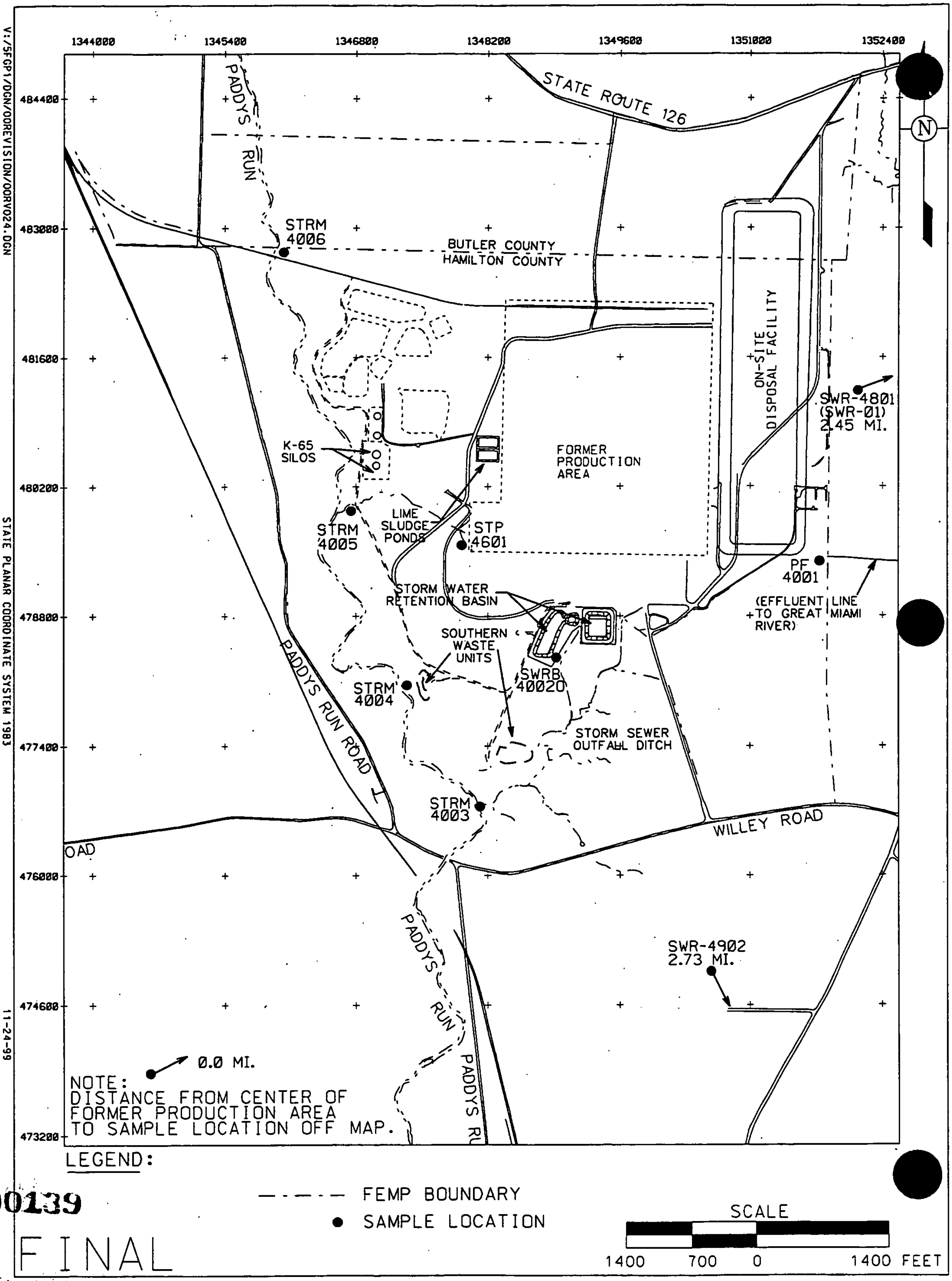

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FIGURE 4-7. NPDES PERMIT SAMPLE LOCATIONS

4.4.2.8 Continue to Fulfill Federal Facilities Compliance Agreement and Operable Unit 5 Record of Decision Requirements

As noted in Section 4.2.2, the current FFCA sampling and reporting requirements became effective on May 1, 1996. These requirements specify sampling at the Parshall Flume (PF 4001), the Storm Water Retention Basin spillway (SWRB 4002O), the Storm Water Retention Basin bypass (SWRB 4002B), the South Plume extraction wells, and the inactive flyash pile (South Field Leachate System). In addition to these sampling requirements, an estimate of the amount of uranium reaching Paddys Run via uncontrolled storm water runoff is calculated. The IEMP will incorporate sampling of the first three above-described locations and will include a uranium calculation for uncontrolled storm water runoff, the Parshall Flume, and the Storm Water Retention Basin spillway. Section 3.0 discusses sampling of the South Plume extraction wells. Due to the ongoing excavation activities at the southern waste units, the sampling of the South Field Leachate System will no longer be conducted. As discussed in Section 8.0, monitoring data for each of the four remaining FFCA monitoring locations and calculation of the amount of uranium reaching Paddys Run have been incorporated into the comprehensive IEMP reporting structure.

The sampling agreement implemented on May 1, 1996 (DOE 1996a) noted that, pending further evaluation, several radiological constituents might be deleted from the FFCA sampling of treated effluent. Further evaluation was performed in the comprehensive point-by-point constituent selection evaluation completed in support of this IEMP surface water and treated effluent sampling program; therefore, the radiological constituents selected for the treated effluent sampling point at the Parshall Flume are composed of:

- Those radiological constituents of concern that have been detected above their respective human-health-based surface water FRL at any point upstream of the Parshall Flume
- Those radiological constituents of concern that were found to be both present in those areas where surface water is controlled and ultimately routed to the Storm Water Retention Basin and/or Parshall Flume, and also mobile to a degree such that surface water may be impacted above FRLs during remediation as indicated by fate-and-transport modeling.

Section 4.4.3 lists these radiological constituents; also listed are all other constituents deemed necessary to fulfill the program expectations outlined in Section 4.4.1 for the Parshall Flume treated effluent sample location as a result of the IEMP constituent-selection process.

4.4.2.9 Continue to Fulfill DOE Order 5400.1 Requirements

The design considerations provided above, which were based on information and conclusions derived from the existing DOE-compliant environmental monitoring program as well as the comprehensive findings of the FEMP remedial investigation/feasibility study process, are sufficient to meet or exceed the requirements of DOE Order 5400.1 as summarized in Section 4.2.2.

4.4.2.10 Continue to Address Concerns of the Community

The monitoring derived from Section 4.4.2.4 will be sufficient to address the concerns of the community. These concerns focus on limiting the amount of FEMP related contamination entering Paddys Run and the Great Miami River. This monitoring will provide a comprehensive monitoring program on Paddys Run at the facility boundary and in the treated effluent destined for the Great Miami River. Monitoring will also document the reduction in FEMP-related contamination entering these streams that is anticipated to occur as remediation progresses.

4.4.3 Program Design

This section provides the IEMP surface water and treated effluent sampling program for 2001 and 2002 developed from the design considerations provided in Section 4.4.2. Table 4-3 summarizes the program design by providing the sample locations, the frequency, and the constituents to be sampled for at each location. This table also provides the basis for the locations and constituents with respect to program expectations identified in Section 4.4.1. To simplify the presentation of the surface water and treated effluent program, IEMP Characterization consists of the first four basis columns of Table 4-3. This basis terminology is consistent with the approach used for reporting through the IEMP.

The non-radiological discharge monitoring and reporting related to the NPDES Permit has been incorporated into the IEMP. The radiological discharge monitoring related to the FFCA and Operable Unit 5 Record of Decision has been incorporated into the IEMP.

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TABLE 4-3

SUMMARY OF SURFACE WATER AND TREATED EFFLUENT SAMPLING REQUIREMENTS BY LOCATION

		Basis for Selection of Constituents					
		IEMP Characterization					
Location	Constituent[a]	Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Quarterly	Quarterly	Quarterly	Various	Various
SWP-01 and SWR-01 (SWR-4801) (Paddys Run and Great Miami River Background)	**General Chemistry:**						
	Ammonia					♦[b]	
	Fluoride				♦		
	Nitrate/Nitrite				♦		
	Total hardness					♦[b]	
	Inorganics:						
	Antimony				♦		
	Arsenic				♦		
	Barium				♦		
	Beryllium				♦		
	Cadmium				♦	♦[b]	
	Chromium, Total				♦	♦[b]	
	Cobalt					♦[b]	
	Copper				♦	♦[b]	
	Cyanide				♦		
	Lead				♦	♦[b]	
	Manganese				♦	♦[b]	
	Mercury				♦	♦[b]	
	Molybdenum				♦		
	Nickel				♦	♦[b]	
	Selenium				♦		
	Silver				♦	♦[b]	
	Vanadium				♦		
	Zinc				♦	♦[b]	
	Radionuclides:						
	Cesium-137				♦		
	Lead-210				♦		
	Neptunium-237				♦		
	Plutonium-238				♦		
	Plutonium-239/240				♦		
	Radium-226				♦		
	Radium-228				♦		
	Strontium-90				♦		
	Technetium-99				♦		
	Thorium-228				♦		
	Thorium-230				♦		
	Thorium-232				♦		
	Uranium, Total				♦		

TABLE 4-3
(Continued)

		Basis for Selection of Constituents					
		IEMP Characterization					
Location	Constituent[a]	Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Quarterly	Quarterly	Quarterly	Various	Various
SWP-01 and SWR-01 (SWR-4801) (Paddys Run and Great Miami River Background) - Contd.	**Pesticides/PCBs:**						
	alpha-Chlordane				♦		
	Aroclor-1254				♦		
	Aroclor-1260						
	Dieldrin				♦		
	Semi-Volatiles:						
	Benzo(a)anthracene				♦		
	Benzo(a)pyrene				♦		
	bis(2-Chloroisopropyl)ether				♦		
	bis(2-Ethylhexyl)phthalate				♦		
	Dibenzo(a,h)anthracene				♦		
	3,3'-Dichlorbenzidine				♦		
	Di-n-butylphthalate				♦		
	Di-n-octylphthalate				♦		
	p-Methylphenol				♦		
	4-Nitrophenol				♦		
	Volatiles:						
	Benzene				♦		
	Bromodichloromethane				♦		
	Bromomethane				♦		
	Chloroform				♦		
	1,1-Dichloroethene				♦		
	Methylene chloride				♦		
	Tetrachloroethene				♦		
	1,1,1-Trichloroethane				♦		
	1,1,2-Trichloroethane				♦		
SWP-02 (Paddys Run)	**Inorganics:**						
	Beryllium		♦				
	Cadmium		♦				
	Chromium, Total		♦				
	Copper		♦				
	Manganese		♦				
	Mercury		♦				
	Radiouclides:						
	Technetium-99	♦	♦				
	Uranium, Total		♦				

TABLE 4-3
(Continued)

		Basis for Selection of Constituents					
		IEMP Characterization					
Location	Constituent[a]	Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Quarterly	Quarterly	Quarterly	Various	Various
SWP-03 (Paddys Run at Downstream Property Boundary)	**Inorganics:**						
	Barium		♦				
	Beryllium		♦				
	Cadmium		♦				
	Chromium, Total		♦				
	Copper		♦				
	Cyanide	♦					
	Lead		♦				
	Manganese		♦				
	Mercury	♦	♦				
	Selenium		♦				
	Silver	♦	♦				
	Zinc	♦					
	Radionuclides:						
	Lead-210			♦			
	Radium-226	♦					
	Strontium-90	♦					
	Technetium-99		♦				
	Uranium, Total	♦	♦				
	Semi-Volatiles:						
	3,3'-Dichlorobenzidine			♦			
	bis(2-Ethylhexyl)phthalate		♦				
	Benzo(a)anthracene			♦			
	Benzo(a)pyrene			♦			
	Di-n-octylphalate		♦				
	Dibenzo(a,h)anthracene			♦			
	Volatiles:						
	Tetrachloroethene		♦				
	1,1,1-Trichloroethane		♦				
SWD-01 (Northeast Drainage)	**Inorganics:**						
	Beryllium		♦				
	Cyanide	♦	♦				
	Lead		♦				
	Manganese		♦				
	Mercury	♦					
	Zinc		♦				
	Radionuclides:						
	Uranium, Total	♦					

000145

TABLE 4-3
(Continued)

		Basis for Selection of Constituents					
		IEMP Characterization					
Location	Constituent[a]	Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Quarterly	Quarterly	Quarterly	Various	Various
SWD-02 (Storm Sewer Outfall Ditch)	**Inorganics:**						
	Cadmium		♦				
	Manganese		♦				
	Radionuclides:						
	Strontium-90	♦					
	Technetium-99	♦					
	Uranium, Total	♦	♦[c]				
	Semi-Volatiles:						
	bis(2-Ethylhexyl)phthalate		♦				
SWD-03 (Waste Storage Area)	**Inorganics:**						
	Barium		♦				
	Chromium, Total		♦				
	Copper		♦				
	Cyanide	♦					
	Lead		♦				
	Manganese		♦				
	Mercury	♦					
	Silver	♦					
	Zinc	♦					
	Radionuclides:						
	Technetium-99	♦					
	Uranium, Total		♦[c]				
	Semi-Volatiles:						
	bis(2-Ethylhexyl)phthalate		♦				
	Volatiles:						
	Tetrachloroethene		♦				
	1,1,1-Trichloroethane		♦				
PF 4001 (Parshall Flume - Treated Effluent)	**General Chemistry:**						
	Ammonia					♦ 3/Week[d]	
	Carbonaceous biochemical oxygen demand					♦ 2/Week	
	Total residual chlorine					♦ 3/Week	
	Oil and grease					♦ 2/Week	
	Total suspended solids					♦ Daily	
	Inorganics:						
	Beryllium		♦				
	Cadmium		♦			♦ 3/Week	
	Chromium, Total		♦			♦ 3/Week	

3320

TABLE 4-3
(Continued)

Location	Constituent[a]	Basis for Selection of Constituents: IEMP Characterization: Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Quarterly	Quarterly	Quarterly	Various	Various
PF 4001 (Parshall Flume - Treated Effluent) - Contd.	Cobalt					♦ 2/Week	
	Copper		♦			♦ 3/Week	
	Cyanide	♦	♦			♦ 3/Week	
	Lead					♦ 3/Week	
	Manganese		♦			♦ 2/Week	
	Mercury	♦	♦			♦ Monthly	
	Nickel					♦ 3/Week	
	Silver	♦				♦ 3/Week	
	Zinc					♦ 3/Week	
	Radionuclides:						
	Lead-210			♦			
	Radium-226	♦					
	Radium-228		♦				♦ Monthly
	Strontium-90	♦					
	Technetium-99	♦	♦				♦ Monthly
	Uranium, Total	♦	♦				♦ Daily
	Semi-Volatiles:						
	Benzidine					♦ Monthly	
	Benzo(a)anthracene		♦				
	Benzo(a)pyrene		♦				
	Dibenzo(a,h)anthracene		♦				
	Di-n-octylphthalate		♦				
	3,3'-Dichlorobenzidine		♦				
	Pentachlorophenol					♦ Monthly	
	Trichloroethene					♦ Monthly	
	Toxaphene					♦ Monthly	
	2,3,7,8-Tetrachlorodibenzo-p-dioxin					♦ Quarterly	
	Other:						
	Flow Rate					♦ Daily	
SWRB 4002O[e] (Storm Water Retention Basin)	**General Chemistry:**						
	Total residual chlorine					♦ Daily	
	Total suspended solids					♦ Daily	
	Inorganics:						
	Beryllium		♦				
	Cadmium		♦				
	Copper					♦ Monthly	
	Cyanide	♦	♦				
	Manganese		♦				
	Mercury	♦	♦			♦ Monthly	

000146

TABLE 4-3
(Continued)

Location	Constituent[a]	Basis for Selection of Constituents: IEMP Characterization: Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Quarterly	Quarterly	Quarterly	Various	Various
SWRB 4002O[c] (Storm Water Retention Basin) - Contd.	**Radionuclides:**						
	Radium-226	♦					
	Radium-228		♦				
	Strontium-90	♦					
	Technetium-99	♦	♦				
	Uranium, Total	♦					♦ Daily
	Other:						
	Flow rate					♦ Daily	
SWRB 4002B (Treatment Bypass)	**Radionuclide:**						
	Uranium, Total						♦ Daily during bypass
STRM 4003, STRM 4004, STRM 4005, STRM 4006 (Drainages to Paddys Run)	**General Chemistry:**						
	Total suspended solids					♦ Semiannually	
	Total residual chlorine (4003, 4005, 4006)					♦ Semiannually	
	Inorganics:						
	Copper (4003, 4004, 4006)					♦ Semiannually	
	Lead (4004, 4005, 4006)					♦ Semiannually	
	Mercury					♦ Semiannually	
	Silver					♦ Semiannually	
	Radionuclides:						
	Uranium, Total	♦	♦				
	Other:						
	Fecal coliform					♦ Semiannually	
	Flow Rate					♦ Semiannually	
STP 4601 (Sewage Treatment Plant Effluent)	**General Chemistry:**						
	Carbonaceous biochemical oxygen demand					♦ Twice a week	
	Ammonia					♦ Every two weeks	
	Total suspended solids					♦ Twice a week	

TABLE 4-3
(Continued)

		Basis for Selection of Constituents					
		IEMP Characterization					
Location	Constituent[a]	Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Quarterly	Quarterly	Quarterly	Various	Various
STP 4601 (Sewage Treatment Plant Effluent) - Contd.	**Other:**						
	Fecal coliform					♦ Weekly (May-Oct.)	
	Flow rate					♦ Daily	
SWR-4902 (Downstream of FEMP effluent)	**General Chemistry:**						
	Ammonia					♦ Quarterly	
	Total hardness					♦ Quarterly	
	Inorganics						
	Cadmium					♦ Quarterly	
	Chromium					♦ Quarterly	
	Cobalt					♦ Quarterly	
	Copper					♦ Quarterly	
	Lead					♦ Quarterly	
	Manganese					♦ Quarterly	
	Mercury					♦ Quarterly	
	Nickel					♦ Quarterly	
	Silver					♦ Quarterly	
	Zinc					♦ Quarterly	

[a]Field parameter readings, taken at each location, include temperature, specific conductance, pH, and dissolved oxygen.
[b]Refers only to location SWR-01 (new NPDES location SWR-4801); constituents sampled quarterly
[c]SWD-02 and SWD-03 surface water will be sampled monthly for total uranium to determine effects of waste storage area remediation activities.
[d]Sampled twice a week in winter (November 1 through April 30)
[e]Constituents will be analyzed at each overflow event.

Near the completion of site remediation, sampling will occur to certify that the surface water pathway at the FEMP is meeting the obligations set forth in the Operable Unit 5 Record of Decision.

4.5 MEDIA-SPECIFIC PLAN FOR SURFACE WATER AND TREATED EFFLUENT SAMPLING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the IEMP surface water and treated effluent sampling program. The activities described in this media-specific plan were designed to provide surface water and treated effluent data of sufficient quality to meet the program expectations as stated in Section 4.4.1. The program expectations, in conjunction with the design considerations presented in Section 4.4.2, were used as the framework for developing the monitoring approach presented in this plan. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 1998a).

Subsequent sections of this media-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance.

4.5.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this media-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

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Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support and assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standard and assist in evaluating and resolving all quality related concerns.

4.5.2 Sampling Program

To fulfill the requirements of the integrated surface water and treated effluent program, surface water and treated effluent samples shall be collected from locations shown in Figures 4-4, 4-6, and 4-7. Table 4-3 summarizes the surface water and treated effluent sampling frequency and location-specific analytical suites. Tables 4-4 and 4-5 provide the sample collection and analytical method information for these locations and constituents.

Sample analysis will be performed at the on-site FEMP laboratory or a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Sections 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

TABLE 4-4

SURFACE WATER ANALYTICAL REQUIREMENTS FOR CONSTITUENTS AT SAMPLE LOCATIONS SWD-01, SWD-02, SWD-03, SWP-01, SWP-02, SWP-03, AND SWR-01[a]

Constituent	Analytical Method	ASL[b]	Holding Time	Preservative	Container
General Chemistry:					
Fluoride	300.0[c], 340.2[c], or 4500C[d]	B	28 days	None	Plastic
Nitrate/Nitrite	353.1[c], 353.3[c], 4500D[d], or 4500E[d]	B	28 days	Cool 4°C, H_2SO_4 to pH < 2	Plastic or glass
Inorganics:					
Antimony Arsenic Barium Beryllium Cadmium Chromium, Total Copper Lead Manganese Molybdenum Nickel Selenium Silver Vanadium Zinc	7000A[e], 3500[d], or 6010B[e]	B	6 months	HNO_3 to pH ≤ 2	Plastic or glass
Mercury	7470A[e]	B	28 days	HNO_3 to pH < 2	Plastic or glass
Cyanide	9010[e], 9012[e], 335.2[c], or 335.3[c]	B	14 days	Cool 4°C, NaOH to pH > 12	Plastic or glass
Radionuclides:					
Cesium-137 Lead-210 Neptunium-237 Plutonium-238 Plutonium-239/240 Radium-226 Radium-228 Strontium-90 Technetium-99 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	SCQ[f]	B	6 months	HNO_3 to pH < 2	Plastic or glass

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TABLE 4-4
(Continued)

Constituent	Analytical Method	ASL[b]	Holding Time	Preservative	Container
Pesticides/PCBs:					
alpha-Chlordane Dieldrin Aroclor-1254 Aroclor-1260	8081A[e] or 8082[e]	B	7 days to extraction 40 days from extraction to analysis	Cool 4°C	Glass (amber)
Volatiles:					
Benzene Bromodichloromethane Bromomethane Chloroform 1,1-Dichloroethene Methylene chloride Tetrachloroethene 1,1,1-Trichloroethane 1,1,2-Trichloroethane	8260B[e]	B	7 days or 14 days	Cool 4°C or Cool 4°C, H_2SO_4, HCl, or solid $NaHSO_4$ to pH < 2	Glass (Teflon)
Semi-Volatiles:					
bis(2-Chloroisopropyl)ether bis(2-Ethylhexyl)phthalate 3,3'-Dichlorobenzidine Di-n-butylphthalate Di-n-octylphthalate p-Methylphenol 4-Nitrophenol	8270C[e]	B	7 days to extraction 40 days from extraction to analysis	Cool 4°C	Glass (amber)
Benzo(a)anthracene Benzo(a)pyrene Dibenzo(a,h)anthracene	8310[e]	B	7 days to extraction 40 days from extraction to analysis	Cool 4°C	Glass (amber)
Field Parameters:[g]	SCQ[h]	A	NA[i]	NA[i]	NA[i]

[a]Only sample locations SWP-01 and SWR-01 are analyzed for all constituents listed in this table. The remaining sample locations are analyzed for a subset of these constituents which is summarized in Table 4-3.
[b]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[c]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020
[d]Standard Methods for the Analysis of Water and Wastewater, 17th edition
[e]Test methods for evaluating solid waste, physical/chemical methods, SW-846
[f]Radionuclide analyses do not have standard methods; Appendix G of the SCQ provides performance specifications.
[g]Field parameters include temperature, specific conductance, pH, and dissolved oxygen.
[h]Appendix K of the SCQ provides field methods.
[i]NA = not applicable

TABLE 4-5

SURFACE WATER AND EFFLUENT ANALYTICAL REQUIREMENTS FOR CONSTITUENTS AT SAMPLE LOCATIONS PF 4001, STP 4601, STRM 4003, STRM 4004, STRM 4005, STRM 4006, SWRB 4002O, SWRB 4002B, SWR-4801, AND SWR-4902

Constituent[a]	Analytical Method[b]	Sample Type[c]	ASL[b,d]	Holding Time[b]	Preservative[b]	Container[b]
General Chemistry:						
Ammonia	350.1[e], 350.3[e], 4500C[f], or 4500F[f]	Composite or Grab[g]	B	28 days	Cool 4°C, H_2SO_4 to pH < 2	Plastic or glass
Carbonaceous biochemical oxygen demand	5210B[f]	Composite	B	48 hours	Cool 4°C	Plastic or glass
Chlorine, residual	4500[f]	Grab	B	Analyze immediately	None	Plastic or glass
Oil and grease	9070[f], 5520B[f], or 413.1[e]	Grab	B	28 days	Cool 4°C, H_2SO_4 to pH < 2	Glass
Total hardness	2340C[f]	Grab	B	28 days	Cool 4°C, H_2SO_4 to pH < 2	Plastic
Total suspended solids	160.2[e] or 2540D[f]	Composite	B	7 days	Cool 4°C	Plastic or glass
Inorganics:						
Aluminum Beryllium Cadmium Chromium, Total Cobalt Copper Lead Manganese Nickel Silver Zinc	7000A[h], 3500[f], 6010B[h], 220.2[e], or 272.2[e]	Composite or Grab[g]	B	6 months	HNO_3 to pH < 2	Plastic or glass
Mercury	7470A[h] or 1631[e,i]	Grab	B	28 days	HNO_3 to pH < 2	Plastic or glass
Cyanide, Free	9010[h], 9012[h], 335.2[e], or 335.3[e] or 4500-CNI[f]	Grab	B	14 days	Cool 4°C, NaOH to pH > 12	Plastic or glass
Radionuclides:						
Lead-210 Radium-226 Radium-228 Technetium-99 Strontium-90	SCQ[j]	Grab	B	6 months	HNO_3 to pH < 2	Plastic or glass
Uranium, Total	SCQ[j]	Grab/Composite[k]	B	6 months	HNO_3 to pH < 2	Plastic or glass

TABLE 4-5
(Continued)

Constituent	Analytical Method[c]	Sample Type[b]	ASL[c,d]	Holding Time[c]	Preservative[c]	Container[c]
Volatiles:						
Trichloroethene	8260B[h]	Grab		14 days	H_2SO_4 pH < 2 Cool 4°	Glass (teflon)
Semi-Volatiles:						
Benzo(a)anthracene	8310[f]	Grab	B	7days to extraction 40 days from extraction to analysis	Cool 4°C	Glass (amber)
Benzo(a)pyrene						
Dibenzo(a,h)anthracene						
Benzidine	605[e]	Grab			Cool 4°C	Glass (amber)
Pentachlorophenol	8270[h]	Grab				Glass (amber)
Toxaphene	8081A[h]	Grab				Glass (amber)
2,3,7,8-Tetrachlorodibenzo-p-dioxin	8290B[h]	Grab				Glass (amber)
3,3'-Dichlorobenzidine	8270C[h]					
Di-n-octylphthalate						
Other:						
Fecal coliform	9222D[f]	Grab	B	6 hours	Cool 4°C	Plastic or glass (sterile)
Flow rate	NA	24 hour total	NA	NA	NA	NA
Field Parameters[l]:	SCQ[m]	Grab	A	NA	NA	NA

[a]This represents a comprehensive list of constituents taken from the indicated list of surface water and treated effluent monitoring locations. Each individual location will be analyzed for a subset of these constituents which is summarized in Table 4-3.

[b]NA = not applicable

[c]For composite samples for PF 4001 and STP 4601, collect a flow-weighted composite sample over a 24 hour period; for SWRB 4002O, SWRB 4002B, STRM 4003, STRM 4004, STRM 4005, and STRM 4006, composite samples shall be comprised of four samples collected at intervals of at least 30 minutes but not more than two hours.

[d]The ASL may become more conservative if necessary to meet detection limits or data quality objectives.

[e]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020

[f]Standard Methods for the Analysis of Water and Wastewater, 17th Edition

[g]Grab samples are collected at locations SWR-4801 and SWR-4902 for this constituent.

[h]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846

[i]Method 1631 for mercury analysis will only be used at NPDES Permit locations where mercury sampling is required.

[j]Radionuclide analyses do not have standard methods; performance specifications are provided in Appendix G of the SCQ.

[k]Total uranium is a grab sample at STRM 4003, STRM 4004, STRM 4005, and STRM 4006 and a composite sample at all other locations.

[l]Field parameters include dissolved oxygen, pH, specific conductance, and temperature.

[m]Appendix K of the SCQ provides field analytical methods.

4.5.2.1 Sampling Procedures

Specific sampling procedures associated with surface water and treated effluent are separately discussed within this section. The procedures provide sampling instructions, which meet the applicable requirements, outlined in the SCQ as follows:

Sitewide CERCLA Quality (SCQ) Assurance Project Plan

Section 4	Quality Assurance Objectives
Section 5	Field Activities
Section 6	Sampling Requirements
Section 7	Sample Custody
Section 8	Calibration Procedures and Frequency
Appendix I	Field Calibration Requirements
Appendix J	Field Activity Methods
Appendix K	Sampling Methods

Surface Water Sampling

Surface water samples will be collected from locations in Paddys Run, drainage ditches to Paddys Run, the northeast drainage, the spillway of the Storm Water Retention Basin and the Great Miami River. A qualitative assessment of flow conditions (i.e., base flow, storm flow, or between storm and base flow) will be documented at the time of sample collection at each of these locations. Sampling personnel will ensure that access to the sample locations will not result in the inadvertent introduction of foreign materials into the water sample. Additional precautions will be taken to avoid the introduction of floating organic material such as leaves or twigs during sample collection. Samples will be collected without disturbing bottom sediment. Sample technicians shall approach sample locations from downstream of the location; if sample locations are accessed by way of a bridge, samples shall be collected on the upstream side of the bridge. Associated surface water sampling procedures are:

Standard Operating Procedures

43-C-113	NPDES Sampling
43-C-108	IEMP Surface Water Sampling
43-C-104	Horiba Water Quality Meter Calibration, Operation, and Maintenance
EW-0002	Chain of Custody/Request for Analysis Record for Sample Control

Samples will be collected using the methods outlined in these procedures including the collection method, container, preservative, and documentation. Tables 4-4 and 4-5 identify the sample preservative, volume, and container requirements for each constituent.

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Treated Effluent Sampling

Treated effluent will be collected by means of flow-proportional samplers at the Parshall Flume and at the new sewage treatment plant (STP 4601). Storm water is also sampled from a bypass pipeline when storm water collected in the Storm Water Retention Basin is diverted from treatment during periods of heavy rainfall. Sampling will be conducted according to the following procedures:

Standard Operating Procedures

EW-0002	Chain of Custody/Request for Analysis Record for Sample Control
43-C-108	IEMP Sampling
43-C-113	NPDES Sampling

After every 24 hours of operation, the collected liquid is removed from the automatic sampler to provide a daily flow-weighted sample of the treated effluent. A portion of each daily sample is analyzed to determine the estimate of total uranium discharged to the Great Miami River for the day. The Parshall Flume, the new sewage treatment plant, and Storm Water Retention Basin bypass samples will be analyzed for the constituents listed in Table 4-3 for the respective locations. Table 4-5 lists the sample preservative, volumes, container requirements, and analytical methods for each constituent.

4.5.2.2 IEMP Quality Control Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as sampling technique, may be responsible for introducing bias in the project's analytical results. Quality control samples will be collected as outlined in Section 4.1.1 and Appendix A, Table 2-3 of the SCQ as follows:

- A duplicate sample shall be collected each quarter at a randomly selected sample location.
- Trip blanks will be prepared and placed in coolers containing samples for volatile organic compound analysis and shall accompany the samples from collection to receipt at the laboratory.
- Field blanks will be collected for each day of quarterly surface water sampling.

4.5.2.3 Decontamination

In general, decontamination of equipment is minimized because reusable equipment is not used during sample collection. However, if decontamination is required, then equipment will be cleaned between sample locations. The decontamination shall be Level II decontamination as referenced in Section K.11 of the SCQ. Sampling bailers used in sampling for mercury at NPDES Permit locations will be decontaminated at a contract laboratory.

4.5.2.4 Waste Dispositioning

Contact waste that is generated by the field technicians during field sampling activities are collected, maintained, and dispositioned, as necessary, depending upon the location of waste generation (i.e., former production area or off site). Contact waste generated outside of radiological control areas will be placed in a clean trash dumpster. Contact waste generated within radiological control areas will be disposed of in a designated radiological contact waste container.

4.5.3 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have approval by the designee and quality assurance representative prior to implementation. In accordance with Section 15.3 of the SCQ, the completed Variance/Field Change Notice must be approved by quality assurance within one week of verbal approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the media-specific plan.

4.5.4 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified fieldwork will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the fieldwork required by this media-specific plan. Safety meetings will be conducted prior to beginning fieldwork to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed applicable training.

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For areas that are subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits are necessary and will be obtained prior to the fieldwork being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a radiation work permit.

4.5.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2001 and 2002 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying media-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with media-specific plan-specified analytical support levels (ASLs). Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. For surface water in 2001 and 2002, field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives. In general, ASL B is appropriate for laboratory generated data collected in 2001 and 2002, because the data are being used for surveillance during site restoration. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

4.5.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ and FEMP Quality Assurance Program (RM-0012) requirements.

Recommended quarterly quality assurance assessments or surveillances shall be performed on tasks specified in the media-specific plan. These assessments may be in the form of independent assessments or self-assessments, with at least one independent assessment conducted annually. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

4.6 IEMP SURFACE WATER AND TREATED EFFLUENT MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP surface water and treated effluent sampling program in 2001 and 2002. This section summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated surface water and treated effluent data, including specific information to be reported in IEMP quarterly summaries and in annual integrated site environmental reports, is also provided.

4.6.1 Data Evaluation

Data resulting from the IEMP surface water and treated effluent program will be evaluated to meet the program expectations identified in Section 4.4.1. Based on these expectations, the following questions will be answered through the surface water and treated effluent data evaluation process, as indicated:

- Are surface water contaminant concentrations such that cross-media impacts to the underlying aquifer could be expected?

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Data from sample locations near areas where the glacial overburden is breached by site drainages will be compared to surface water and groundwater FRLs to assess potential impacts to the Great Miami Aquifer. Basic statistics, such as the minimum, maximum, and mean, will be generated on a yearly basis. The data generated from individual sampling events will be trended by sample location over time via graphical and, if necessary, statistical methods when sufficient data become available. Should trends above the historical ranges or above FRLs be observed, actions shown in Figure 4-8 will be implemented. Integration of surface water information generated by project-specific monitoring will occur as necessary to determine which project(s) may have caused the observed trend. The findings of data evaluations will be shared with project personnel. Those personnel responsible for the restoration of the Great Miami Aquifer will be informed so that any potential adverse cross-media impacts can be factored into the site groundwater remedy. The Soil and Disposal Facility Project and other source projects will be informed of the findings such that the actions indicated in the decision-making process described in Figure 4-8 can be implemented.

- Do the sporadic exceedances of FRLs and/or BTVs continue to occur, decrease, or increase?

Data evaluation will consist of direct comparison of data to FRLs and/or BTVs. If constituents identified as sporadic exceedances are no longer detected above FRLs and/or BTVs in the surface water and treated effluent at individual locations for one calendar year of sampling (a minimum of four quarters of samples), then the constituent will be removed from the IEMP surface water and treated effluent monitoring program at the identified location unless the constituent was also identified as having the potential to cause an exceedance of surface water FRLs or BTVs based on modeling (Table 4-2). Data will be further evaluated to determine if the constituent can be removed from additional downstream sample locations. Area-specific constituents of concern having the potential to cause an exceedance of a surface water or groundwater FRL or a surface water BTV based on modeling will continue to be monitored until the sources within the drainage area being monitored are certified as being remediated and the surface water and sediment pathways have been certified as achieving the FRLs specified in the Operable Unit 5 Record of Decision.

- Have uncontrolled runoff and implementation of FEMP remediation activities caused an undue adverse impact to the surface water or treated effluent?

FIGURE 4-8
IEMP SURFACE WATER DATA EVALUATION AND ASSOCIATED ACTIONS

Identify locations of projects active during monitoring period

↓

Monitor at key locations for indicator constituents downstream of active projects

- Intermediate Locations
- Property Boundary Locations

↓

Evaluate surface water constituent concentrations against historical ranges, FRLs, BTVs, and NPDES Permit limits

If concentration is within historical ranges → Continue scheduled monitoring

If concentration > historical ranges, but < FRLs, BTVs and NPDES Permit limits[a]	
IEMP Actions	Potential Project Actions
• Identify probable sources and alert associated projects • Continue scheduled monitoring • Trend data to determine potential for unacceptable future conditions • Report information to EPA/OEPA in next IEMP quarterly summary and in the annual report • Notify ARWWP of potential cross-media impacts	• Review performance/ inspection data for engineered controls • Determine if engineered controls meet design specifications • Repair engineered controls, if necessary

[a]For those constituents/locations with limited historical data, IEMP data will be compared to background concentrations.

If concentration > FRL, BTVs, or NPDES Permit limit	
IEMP Action	Potential Project Action
• Identify probable source areas and alert associated projects • Conduct confirmatory sampling to determine persistence • Continue scheduled monitoring • Report information to EPA/ OEPA in next IEMP quarterly summary and in the annual report • Report NPDES noncompliance to OEPA immediately • Notify ARWWP of potential cross-media impacts	• Review performance/ inspection data for engineered controls • Determine if engineered controls meet design specifications • Repair engineered controls, if necessary • Estimate duration of source activities • Field modification of controls • Quantify release

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Data evaluation to determine the impact of FEMP remediation activities on surface water or treated effluent will consist of direct comparison of data to surface water FRLs and/or BTVs. This assessment will not include data collected from internal monitoring locations within the treated effluent systems (i.e., STP 4601 and SWRB 4002B). To provide a better understanding of the uncontrolled runoff flow patterns as FEMP remediation activities are occurring, updates of the uncontrolled runoff flow directions will also be reported. Additionally, trend analyses of data will be used to identify trends that may require implementation of additional surface water controls to avoid exceedance of FRLs and/or BTVs.

If increasing trends are observed, then project-specific data will be evaluated to determine which project(s) are adversely affecting surface water or treated effluent quality. Data evaluation findings will be communicated to source project personnel, as appropriate.

- Have sufficient data been collected to determine if FRLs are exceeded for: 1) constituents with a paucity of historic analysis; or 2) constituents with historic detection levels above the FRL?

Data evaluation to address these questions will consist of direct comparison of data to the respective FRL and/or BTV. Analysis of constituents for which little historical data exists or for which the detection limit exceeded the FRL or BTV will continue until sufficient data exist to determine whether the FRLs and/or BTVs for these constituents are exceeded. If these constituents are not detected above FRLs in the surface water for one calendar year of sampling (a minimum of four quarters of samples), then the constituent will be removed from the IEMP surface water monitoring program unless the constituent was also identified as having the potential to cause an exceedance of a surface water FRL or BTV based on modeling (Table 4-2). Area-specific constituents of concern having the potential to exceed a surface water or groundwater FRL or a surface water BTV based on modeling will continue to be monitored until the sources within the drainage area being monitored are certified as being remediated and the surface water and sediment pathways have been certified as achieving the FRLs specified in the Operable Unit 5 Record of Decision.

- How will the FEMP distinguish between site impacts and background concentrations as remediation progresses?

Background values for surface water in Paddys Run and the Great Miami River were originally established under the Characterization of Background Water Quality for Streams and Ground Water Report (DOE 1995a). This report calculated the 95th percentile statistic for various constituents. As additional data are collected under the IEMP, background surface water values for constituents in Paddys Run and the Great Miami River will be refined and presented in future IEMP reports.

- Are the requirements of the NPDES Permit being fulfilled?

Data collected to fulfill the site NPDES Permit requirements will be evaluated for compliance with the NPDES Permit provisions. This evaluation will serve to identify if immediate reporting of noncompliances to the OEPA is necessary, and to determine the appropriate corrective action to address the noncompliance.

- Are the FFCA and Operable Unit 5 Record of Decision reporting requirements being fulfilled?

Radiological discharges to the Great Miami River and Paddys Run are regulated by the FFCA and Operable Unit 5 Record of Decision. Reporting for these requirements have been incorporated into the IEMP reporting structure and include a cumulative summary of pounds of uranium discharged, the number of treatment bypass days per reporting period, and the monthly average total uranium concentration discharged to the Great Miami River.

- Is the program and reporting requirements of DOE Order 5400.1 being met?

DOE Order 5400.1 requires that DOE-FEMP implement and report on an environmental protection program for the FEMP. The surface water and treated effluent monitoring program is one component of the sitewide IEMP monitoring program. This IEMP and annual integrated site environmental reports fulfill the requirements of this DOE Order.

- Are community concerns being met through the surface water and treated effluent IEMP program?

The IEMP fulfills the needs of the Fernald community by preparing surface water and treated effluent environmental results in annual integrated site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center, located a half mile south of the FEMP on Oakridge Drive in the Delta Building. The specific community concern of the magnitude of FEMP discharges to Paddys Run and the Great Miami River is addressed in IEMP quarterly summaries and in annual integrated site environmental reports in the surface water and treated effluent section.

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4.6.2 Reporting

The IEMP surface water and treated effluent program will meet the reporting requirements for the NPDES Permit and the FFCA and Operable Unit 5 Record of Decision compliance, as follows:

- NPDES Permit compliance will continue to be reported monthly.
- The quarterly FFCA reporting has been incorporated into the IEMP reporting structure.

The IEMP surface water and treated effluent data will be reported in the form of a Data Extranet Site (the IEMP Data Information Site), quarterly summaries, and annual integrated site environmental reports. Additional information on IEMP data reporting is provided in Section 8.3.3.

Data pertaining to the surface water and treated effluent program will be provided on an Extranet Site. The data will be in the format of searchable data sets and/or downloadable data files. This site will be updated every two to four weeks, as data become available.

The IEMP quarterly summary will supplement the Extranet Site by providing a brief summary of the data added to the site that quarter and identifying notable results and/or events related to that data. The IEMP quarterly summaries will be submitted at approximately 30 days from the end of the quarter.

The IEMP annual integrated site environmental reports will be issued each June. The comprehensive report will discuss a year of IEMP data previously reported on the Extranet Site and in the quarterly summaries. The IEMP annual integrated site environmental report will include the following:

- An annual summary of data from the IEMP surface water and treated effluent monitoring program
- Constituent concentrations for each sample location
- Statistical analysis summary for constituents, as warranted by data evaluation
- Status of FFCA and Operable Unit 5 Record of Decision Great Miami River effluent limits, to be presented graphically, which include: the 20 µg/L and 600 pound total uranium limits; showing as of January 1, 1998 that the monthly flow-weighted average total uranium limit is 20 µg/L; and, indicating allowable bypass days
- Status of regulatory compliance of the NPDES Permit
- Summary-level information on the effectiveness of the project-specific sediment control structures, if necessary for interpretation of IEMP results

- Actions taken to mitigate unacceptable surface water conditions revealed by the IEMP surface water sampling program

- Observed trends and results of the data comparison to FRLs and/or BTVs.

Because the IEMP is a "living document," a structured schedule of annual reviews and two-year revisions has been instituted. The annual review cycle provides the mechanism for identifying and initiating any surface water and treated effluent program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

Section 5.0

5.0 SEDIMENT MONITORING PROGRAM

Section 5.0 discusses the monitoring strategy for assessing the impact of remediation activities at the Fernald Environmental Management Project (FEMP) on sediments deposited along area surface water drainages. The focus of this program is on sediment outside the areas where surface water and/or sediment controls are in place as a result of the FEMP's active remediation efforts. This strategy identifies integration objectives for the sediment program and the activities necessary to satisfy requirements for sediment monitoring. A media-specific plan for sediment monitoring activities, discussion of sediment data evaluation, and the reporting structure is also provided.

5.1 INTEGRATION OBJECTIVES FOR THE SEDIMENT MONITORING PROGRAM

The Integrated Environmental Monitoring Plan (IEMP) sitewide sediment monitoring program is conducted based on the previous sediment sampling programs at the site and in light of site surface water, and thereby, sediment controls that are now in place and/or planned during remediation. The design considerations for the IEMP sediment monitoring program (discussed in Section 5.4), especially the location of sample points, incorporate these factors. The sitewide sediment pathway has been historically evaluated under two closely linked programs:

- The site's environmental monitoring program, which began in 1974, has provided comprehensive data in the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River for site-specific radiological constituents.
- The remedial investigation/feasibility study characterization of sediment which focused on a broader range of constituents (both radiological and non-radiological) in site drainages, as well as in the Storm Sewer Outfall Ditch, Paddys Run, northeast drainage, and the Great Miami River.

The information produced by these two FEMP programs through 1993 were reported and evaluated in the Remedial Investigation Report for Operable Unit 5 (DOE 1995d) and carried forward into the Feasibility Study Report for Operable Unit 5 (DOE 1995b) for the development of sediment clean-up levels. The Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b) established health-protective final remediation levels (FRLs) for sediment. Achievement of these FRLs will be accomplished within on-site drainages as site soil and sediment are remediated and contaminated source materials are removed.

This presents an opportunity for integration between remediation activities and sediment sampling. For sediment, further investigation to refine remediation needs in the on-property drainages, which feed into Paddys Run, will be conducted, if determined necessary; this investigation would be part of the project-specific soil excavation planning to confirm the extent of sediment to be excavated, along with the contaminated soil in a specific area.

For sediment in Paddys Run and the Great Miami River, the Operable Unit 5 Feasibility Study concluded that while constituents of concern above FRLs or benchmark toxicity values (BTVs) were intermittently detected at some locations, the data demonstrate no discernable trend of contamination to indicate that remediation of this sediment would be required (i.e., the current residual concentration of contaminants in the sediment is such that it is not a significant threat to human health and/or the environment). It is recognized, however, that sediment in Paddys Run and the Great Miami River is dynamic (i.e., conditions continually change, especially following a hard rain when sediment is washed out and replaced by new sediment) and that the sediment data set is limited.

Therefore, although the Operable Unit 5 Feasibility Study concluded, for planning purposes, that remediation of sediment in Paddys Run or the Great Miami River is not likely to be required, verification sampling of sediment will be performed to ensure that sediment remediation activities are not required. The sediment verification sampling is expected to be conducted following the completion of on-property soil remediation activities to ensure that sources, which could release additional contaminated sediment to the environment, are removed prior to the verification. This sediment verification sampling will be completed within Paddys Run and the Great Miami River, which will be defined in future versions of the IEMP when soil and source operable unit remediation is nearly complete. Ultimately, the IEMP will be used to verify and document that the FEMP's sitewide remedial actions result in a condition that no longer poses any long-term threat to human health and/or the environment through the sediment pathway. The constituents of ecological concern that pertain to sediment, as presented in the Sitewide Excavation Plan (DOE 1998d), will be addressed in future IEMP revisions as specific soil remediation areas that are upstream of the on-property drainages, including Paddys Run, undergo certification sampling.

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Under the current IEMP, the sediment monitoring program will continue to provide FEMP stakeholders with comprehensive sediment data to verify the effectiveness of the FEMP's sediment controls during ongoing remediation activities and future activities that will be initiated in 2001 and 2002.

5.2 ANALYSIS OF REGULATORY DRIVERS, DOE POLICIES, AND OTHER FEMP-SPECIFIC AGREEMENTS

This section presents an evaluation of the regulatory drivers governing sediment monitoring during site remediation. The intent of this section is to identify any pertinent regulatory requirements, including applicable or relevant and appropriate requirements and to be considered-based requirements, for the scope and design of the sediment monitoring program. These requirements will be used to confirm that the design specifications satisfy the regulatory obligations stated below and will achieve the intentions of other pertinent criteria, such as U.S. Department of Energy (DOE) Orders and the FEMP's existing agreements, as appropriate that have a bearing on the scope of this monitoring. The results of the evaluation also are used to define, as appropriate for this media, the programmatic boundaries between the IEMP and project-specific emissions-control monitoring conducted by individual project organizations.

5.2.1 Approach

The analysis of the regulatory drivers and policies was conducted by examining the FEMP's approved Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) records of decision to identify any sediment-specific monitoring requirements. An evaluation of the FEMP's regulatory drivers for sediment monitoring was conducted to confirm that pre-IEMP sediment monitoring also meets the additional requirements (if any) for sediment monitoring that may have been activated by each of the FEMP's CERCLA operable unit's record of decision.

5.2.2 Results

The evaluation of regulatory drivers for sediment monitoring resulted in two regulatory requirements governing the technical scope and reporting for the IEMP sediment monitoring program at the FEMP:

- The CERCLA Record of Decision for Remedial Actions at Operable Unit 5 requires remediation of the site such that the sediment pathway is protective of the underlying Great Miami Aquifer and environmental receptors. The FRLs for sediment are specified in the Operable Unit 5 Record of Decision; however, a specified volume or area of sediment to be remediated was not identified due to the sporadic and isolated detections of contaminants above FRLs in sediment. Attainment of sediment FRLs in the northeast drainage, Paddys Run, and the Great Miami River will be determined by monitoring at the end of FEMP remediation activities, as committed to in the Feasibility Study Report for Operable Unit 5.

- The CERCLA Feasibility Study Report for Operable Unit 5 stated that if the concentrations of constituents remain above sediment BTVs after completion of the remedial action, then further investigation and remediation may be warranted. The sediment BTVs listed in the Feasibility

- Study Report for Operable Unit 5 were identified as contaminant concentrations that are protective of ecological receptors.

One other regulatory driver was found to have sediment monitoring implications, but only of a project-specific nature. The project-specific sediment monitoring driver is:

- The CERCLA Record of Decision for Remedial Actions at Operable Unit 5, which requires remediation of the site such that the sediment pathway is protective of the underlying Great Miami Aquifer and environmental receptors. The FRLs for sediment are specified in the Operable Unit 5 Records of Decision; however, a specified volume or area of sediment to be remediated was not identified due to the sporadic and isolated detections of contaminants above FRLs in sediment. Further investigation to refine the extent of excavation in the Storm Sewer Outfall Ditch and other on-site drainages will be conducted, as necessary, by sampling sediment for FRL constituents.

DOE Order 5400.1, General Environmental Protection Program, and DOE Order 5400.5, Radiation Protection of the Public, were also evaluated for any to be considered-based criteria that may drive environmental monitoring of sediment at the FEMP. This evaluation concluded that, although sediment sampling has been conducted under previous sampling based on DOE Orders, continued sediment monitoring is not mandated by DOE Orders in light of the well-characterized current site conditions, planned actions regarding IEMP surface water sampling, and the planned sediment verification sampling both on and off property.

To summarize, there are no regulatory requirements mandating continued sediment monitoring as part of the IEMP program during remediation. However, due to the initiation of remedial actions in new areas (Operable Unit 4) and the continuation of ongoing remedial actions, the sediment sampling scope will be continued under the IEMP for 2001 and 2002 as verification that project-specific sediment controls are effective. Sampling conducted to verify FRL and BTV attainment will primarily occur under the IEMP after remediation has been completed. The analytical program for sediment reflects the primary constituents of concern during active soil remediation areas for 2001 and 2002.

Table 5-1 lists the drivers for the scope of the sediment monitoring program for the IEMP, as well as for project-specific sediment monitoring. Sections 5.6 and 8.0 provide the FEMP's current and long-range plan for the evaluation and reporting of sediment monitoring data.

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TABLE 5-1

FEMP SEDIMENT MONITORING PROGRAM
REGULATORY DRIVERS AND RESPONSIBILITIES

	DRIVER	ACTION
IEMP	Operable Unit 5 Record of Decision	The IEMP will be modified toward completion of the remedial action to include sampling to certify FRL achievement.
	Operable Unit 5 Feasibility Study	The IEMP will be modified toward completion of the remedial action to include sampling for BTV constituents.

	DRIVER	ACTION	PROJECT PLAN
PROJECT	Operable Unit 5 Record of Decision	Sampling of on-site drainage ditches, as necessary, to refine excavation depth	Sitewide Excavation Plan

5.3 PROGRAMMATIC BOUNDARY FOR THE SEDIMENT MONITORING PROGRAM

This section identifies the programmatic boundary that has been established between the IEMP and project-specific activities. The intent behind the boundary definition is to: 1) clearly delineate the scope and geographic extent of the IEMP monitoring responsibility; and 2) establish a recognized interface between the "downstream" surveillance focus of the IEMP and the predominant emission-control and verification (in on-property drainages as part of soil remediation) focus of project-specific monitoring.

The IEMP sediment sampling program will be confined to the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River. The IEMP sediment sampling in these areas will provide surveillance downstream from the project-specific sediment controls currently in place or planned.

Project-specific sediment investigations to refine remediation needs in the Storm Sewer Outfall Ditch and other on-property drainages will be conducted, if determined necessary, as part of the project-specific soil excavation planning. This determination and any follow-up sampling necessary for purposes of verifying the extent of excavation is defined in the Sitewide Excavation Plan. If project-specific sampling is determined to be required in any on-property drainage, then it will be coordinated with the IEMP monitoring of sediments.

5.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

5.4.1 Program Expectations

The 2001 and 2002 sediment monitoring program is essentially a two-year continuation of the IEMP, Revision 1 (DOE 1999), sediment surveillance monitoring program which underwent a slight scope reduction in terms of sediment locations in 1999. The expectations for the program during 2001 and 2002 are to collect data sufficient to:

- Determine if substantive changes to current residual contaminant conditions (as defined by the current sampling program) occur in the sediments found in the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River as a result of runoff from the site, including areas of active remedial excavations, and treated effluent from the FEMP
- Determine if the program should continue as is or be refined in scope as remediation progresses
- Continue to address the concerns of the community associated with remedial activities at the FEMP.

5.4.2 Sediment Program Design Considerations

The design considerations to address the above-listed expectations are as follows:

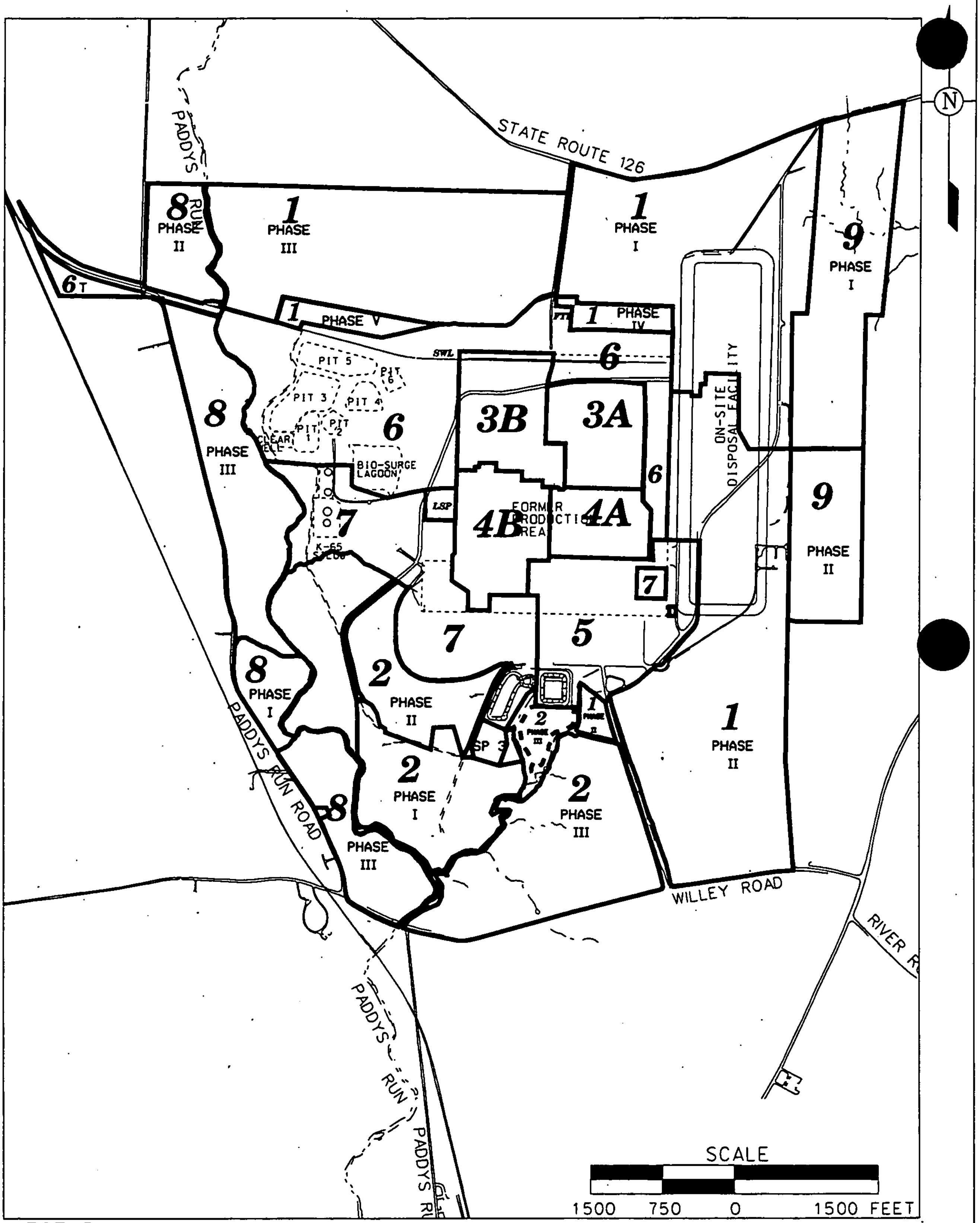
- Sample locations should, in general, be consistent with recent environmental monitoring locations so that comparable areas are evaluated.
- Sampling frequency, constituents analyzed, and the analytical support level (ASL) should be consistent with the recent IEMP monitoring program so that appropriate comparisons can be made and the findings of the annual assessment can be reported to regulatory agencies and the public.

The design of the sediment monitoring program for 2001 and 2002 was developed in recognition of the potential excavation activities and construction activities expected to be active during this time period. These include:

- Excavation activities in the Area 2, Phase I southern waste units (southwest portion of the site)
- Soil excavation activities in Area 3A/4A planned for 2002 (Figure 5-1)
- Construction and waste placement activities associated with Cells 1, 2, 3, and 4 of the on-site disposal facility
- Waste pit excavation, processing and load-out operations associated with Operable Unit 1.

Regarding public concerns of contaminated sediment mobilization, it should be noted that controls currently in place (and planned future controls) for site surface water and sediment runoff from the more highly contaminated areas reduce the contamination leaving the site. This is explained in detail for surface water in Section 4.0. As expected, the sediment sampling results from the 1994 through 1999 monitoring programs indicate reductions of uranium contamination in sediment when compared to remedial investigation/feasibility study and earlier sediment sampling program data collected in the late 1980s and early 1990s. These reductions are attributable to the control of contaminated storm water runoff that began in 1986 with the installation of the Storm Water Retention Basin. The 1999 sediment data indicate:

- Average uranium concentrations measured in sediment from Paddys Run, the Storm Sewer Outfall Ditch, and Great Miami River samples were far below the human-health-protective sediment FRL of 210 milligrams per kilogram (mg/kg) for uranium.
- The maximum uranium concentration in the Storm Sewer Outfall Ditch was 6.65 mg/kg.
- The maximum uranium concentration in any Paddys Run location was 1.8 mg/kg.
- The maximum uranium concentration in the Great Miami River, south of the effluent line, was 1.8 mg/kg.



LEGEND:

- — · — · — FEMP BOUNDARY
- **━━━** REMEDIATION AREA BOUNDARIES
- ***1*** REMEDIATION AREA
- - - - - - PHASE BOUNDARIES

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STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000

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FIGURE 5-1. SITEWIDE REMEDIATION AREAS

In reviewing the sediment data for radium-226, thorium-228, thorium-230, and thorium-232, from 1991 through 1999 that is contained within annual integrated site environmental reports, the following observations are noted:

- For radium-226, out of the 147 samples collected in the Storm Sewer Outfall Ditch and in Paddys Run north of the Storm Sewer Outfall Ditch, there were no observed occurrences above the radium-226 sediment FRL of 2.9 picoCuries per gram (pCi/g). Out of the 147 samples, a maximum concentration of 2.3 pCi/g was observed in 1992 in Paddys Run north of the confluence with the Storm Sewer Outfall Ditch.

- For thorium-228, out of the 142 samples collected in the Storm Sewer Outfall Ditch and in Paddys Run north of the Storm Sewer Outfall Ditch, there were no observed occurrences above the thorium-228 sediment FRL of 3.2 pCi/g. Out of the 142 samples, a maximum concentration of 1.9 pCi/g was observed in 1996 in the Storm Sewer Outfall Ditch.

- For thorium-230, out of the 142 samples collected in the Storm Sewer Outfall Ditch and in Paddys Run north of the Storm Sewer Outfall Ditch, there were no observed occurrences above the thorium-230 sediment FRL of 18,000 pCi/g. Out of the 142 samples, a maximum concentration of 4.0 pCi/g was observed in 1996 in the Storm Sewer Outfall Ditch.

- For thorium-232, out of the 142 samples collected in the Storm Sewer Outfall Ditch and in Paddys Run north of the Storm Sewer Outfall Ditch, there was only one observed occurrence above the thorium-232 sediment FRL of 1.6 pCi/g in 1996 at the Storm Sewer Outfall Ditch (1.80 pCi/g).

Based on the above data, sediments from the FEMP do not currently pose a risk to the public. However, continued monitoring is recommended in this IEMP to determine if this conclusion remains valid during the continuing stages of remediation.

5.4.3 Sediment Program Design

The sediment monitoring program for 2001 and 2002 will continue to provide stakeholders with comprehensive data to assess the impact of FEMP remediation activities. The IEMP, Revision 1, eliminated four sediment monitoring locations based on a nine-year trend of sediment data. This IEMP will maintain the same sediment locations (Figure 5-2) and constituents based on 1998 and 1999 data continuing to follow this trend of low concentrations.

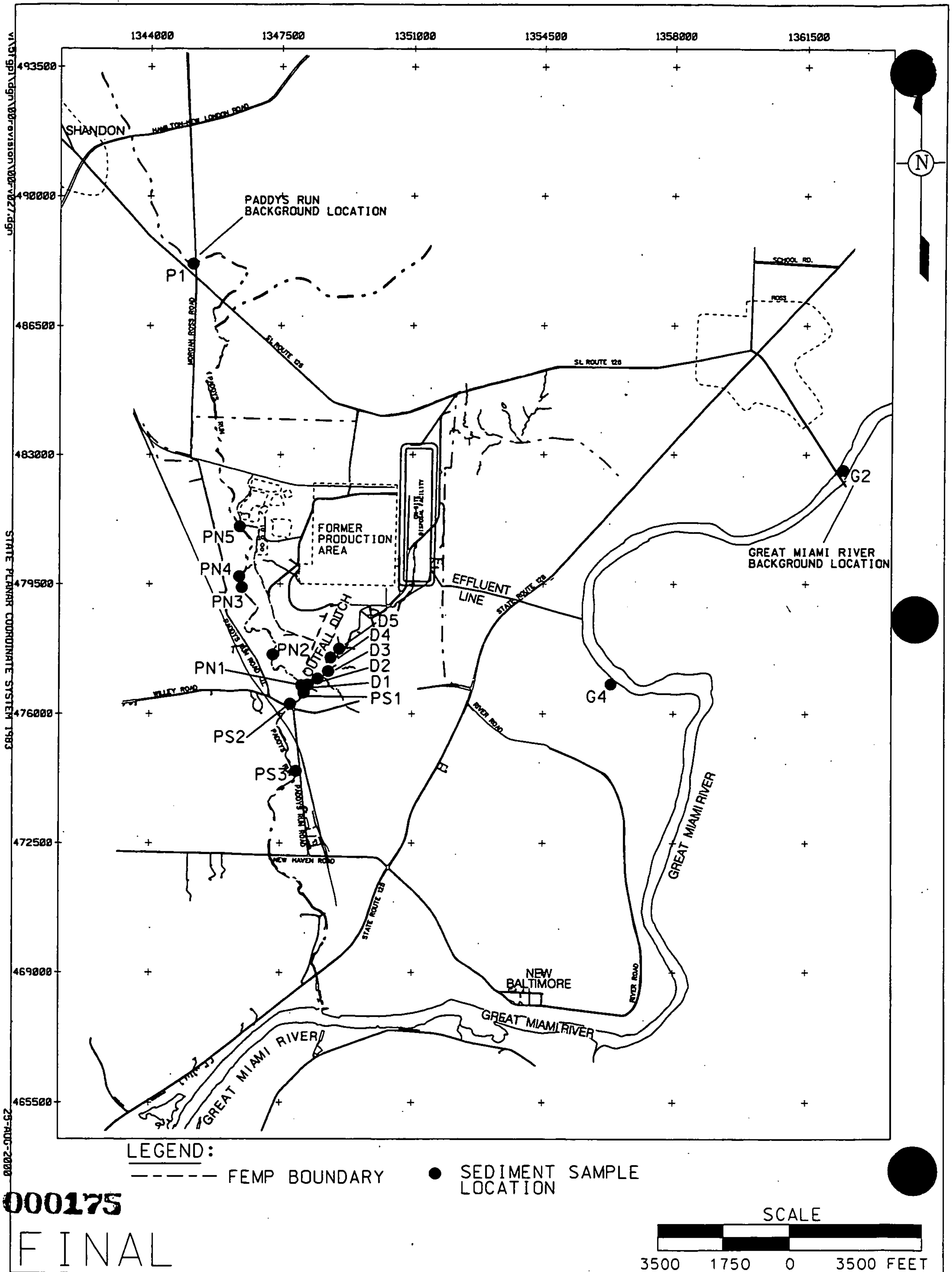

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FIGURE 5-2. SEDIMENT SAMPLE LOCATIONS

Due to recent and planned areas of remedial excavations and waste processing occurring in 2001 and 2002 in all operable units, the primary constituents of concern in the soil and wastes for these areas will be utilized as the analytical suite for all sediment sample locations except for the Great Miami River locations. In addition, the purpose of assessing the primary constituents of concern at location PS1 is to verify that the radiological constituents for the active remedial actions in the operable units (soil excavation, waste processing, construction activities, etc.) are not mobilized and transported to the sediment monitoring locations.

The sediment monitoring program during 2001 and 2002 will include the locations illustrated in Figure 5-2 as follows: one background location along Paddys Run north of the site boundary; eight locations along Paddys Run (five north of the Storm Sewer Outfall Ditch and three south of the Storm Sewer Outfall Ditch) taken at strategic locations to ensure that the most recent sediment deposited is collected; five locations along the Storm Sewer Outfall Ditch; and two locations along the Great Miami River (one background location upstream of the FEMP treated-effluent discharge point and one location just below the FEMP treated-effluent discharge point inside the big bend on the west bank).

Because radium-226, thorium, and uranium are primary contaminants in Operable Units 1 and 4, and the former production area, these constituents are analyzed in samples collected at locations just downstream of these areas (i.e., Paddys Run and in the Storm Sewer Outfall Ditch).

5.5 MEDIA-SPECIFIC PLAN FOR SEDIMENT MONITORING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the sitewide environmental sediment monitoring program. The activities described in this media-specific plan were designed to provide sediment data of sufficient quality to meet the program expectations as stated in Section 5.4.1. The program expectations, in conjunction with the design considerations presented in Section 5.4.2, were used as the framework for developing the monitoring approach presented in this media-specific plan. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 1998a).

Subsequent sections of this media-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Health and safety
- Change control
- Data management
- Project quality assurance.

5.5.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this project-specific plan, in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support, and to assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standards, and to assist in evaluating and resolving all quality related concerns.

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5.5.2 Sampling Program

Sediment samples will be collected annually in the summer from approximately 16 locations within the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River. Sampling is performed in the summer in order to take advantage of the abundance of fresh sediment deposited during flood conditions that commonly occur after the winter and spring seasons. Figure 5-2 depicts the sediment sample locations. Table 5-2 includes a summary of the sample locations, constituents to be analyzed, and the design purposes. Table 5-3 summarizes the field sample collection information for each group of locations. Sample analysis will be performed at the on-site FEMP laboratory or a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Sections 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

5.5.2.1 Sampling Procedures

Sediment sampling is conducted in accordance with standard operating procedures referenced below. The procedures provide sampling instructions which incorporate the requirements outlined in the SCQ as follows:

Standard Operating Procedures	
ADM-02	Field Project Prerequisites
SMPL-01	Solids Sampling
SMPL-21	Collection of Field Quality Control Samples
EW-0002	Chain of Custody/Request for Analysis Record for Sample Control

Sitewide CERCLA Quality (SCQ) Assurance Project Plan	
Section 4	Quality Assurance Objectives
Section 5	Field Activities
Section 6	Sampling Requirements
Section 7	Sample Custody
Section 8	Calibration Procedures and Frequency
Appendix I	Field Calibration Requirements
Appendix J	Field Activity Methods
Appendix K	Sampling Methods

TABLE 5-2

ANNUAL SEDIMENT SAMPLING PROGRAM DESIGN

Location	Constituent	Expectation
Paddys Run background (1 sample location - P1)	Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	Establish range of background concentrations in Paddys Run
Paddys Run north of the Storm Sewer Outfall Ditch (5 sample locations - PN1, PN2, PN3, PN4, and PN5)	Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	Measure the impact of surface water runoff from western portion of the site including the waste pits and K-65 Silos (Operable Units 1 and 4)
Paddys Run south of the Storm Sewer Outfall Ditch (3 sample locations - PS1, PS2, and PS3)	Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	Measure impact of surface water runoff from the site
Storm Sewer Outfall Ditch (5 sample locations - D1, D2, D3, D4, and D5)	Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	Measure the impact of any overflows of the Storm Water Retention Basin surface water runoff from the eastern portion of the site and residual contaminant concentrations from past releases
Great Miami River (1 sample location - G4)	Uranium, Total	Measure the impact of the site effluent
Great Miami River background (1 sample location - G2)	Uranium, Total	Establish range of background concentrations in Great Miami River

TABLE 5-3

SEDIMENT SAMPLE ANALYTICAL REQUIREMENTS

Location	Number of Locations[a]	Sample Frequency	Constituent[b]	ASL[c]	Container[d]	Holding Time	Preservative
Storm Sewer Outfall Ditch (D1, D2, D3, D4, and D5)	5	Annually	Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	B	500 mL glass/plastic jar or plastic bag	6 months	None
Great Miami River (G4)	1	Annually	Uranium, Total	B	500 mL glass/plastic jar or plastic bag	6 months	None
Paddys Run north of the Storm Sewer Outfall Ditch (PN1, PN2, PN3, PN4, and PN5)	5	Annually	Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	B	500 mL glass/plastic jar or plastic bag	6 months	None
Paddys Run south of the Storm Sewer Outfall Ditch (PS1, PS2, and PS3)	3	Annually	Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	B	500 mL glass/plastic jar or plastic bag	6 months	None
Great Miami River background (G2)	1	Annually	Uranium, Total	B	500 mL glass/plastic jar or plastic bag	6 months	None
Paddys Run background (P1)	1	Annually	Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232 Uranium, Total	B	500 mL glass/plastic jar or plastic bag	6 months	None

[a]The number of samples may vary depending on the availability of recently deposited sediment.
[b]Radionuclide analyses do not have standard methods; Appendix G of the SCQ provides performance specifications.
[c]A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives.
[d]Ten liters of rinsate water are necessary to perform the required analyses.

Project-specific sampling considerations are outlined below:

- Only recently deposited surface sediment shall be collected, typically from deposition locations such as slow flow-rate areas (e.g., obstructions in the stream bed).
- Samples shall be collected from the top few centimeters and consist of fine-grained material.
- Sample collection shall begin at the farthest downstream location and proceed upstream.
- Any non-sediment materials shall be discarded from the sample, the sample shall be mixed thoroughly, any free water drained, and placed in the sample container.

The locations of the sediment sample points are approximate and may change from year to year, based on where stream flow has deposited sufficient material for sampling. Sediment samples are collected and analyzed according to Table 5-3.

5.5.2.2 Quality Control Sampling Requirements

Quality control samples will be taken according to the frequency recommended in Appendix A, Table 2-3 of the SCQ and detailed below. These samples will be collected and analyzed to evaluate the possibility that some controllable practice, such as decontamination, sampling or analytical technique, may be responsible for introducing bias in the analytical results. Approximately one field duplicate will be collected for every 20 samples. One rinsate sample will also be collected following decontamination of the sediment sampling scoop or shovel. Ten liters of rinsate water are necessary to perform the required analyses.

The State of Ohio, through its Agreement in Principle with DOE, empowers the Ohio Environmental Protection Agency (OEPA) to take samples that are independent of the split-sampling program. In addition, sediment samples may be split annually in accordance with the Agreement in Principle. These samples further supplement the quality assurance program by providing a means to evaluate comparability between laboratories. Samples collected with OEPA are analyzed for the same constituents as those established in Table 5-3 for the location being sampled.

5.5.2.3 Decontamination

Decontamination of sampling equipment will be performed between sample locations to prevent the introduction of contaminants or cross-contamination into the sampling process. The decontamination shall be Level II decontamination as referenced in Section K.11 of the SCQ.

5.5.2.4 Waste Dispositioning

Contact wastes that are generated by the field technicians during field sampling activities are collected, maintained, and dispositioned depending upon the location of waste generation (i.e., former production area or off site). Contact waste generated outside of radiological control areas will be placed in a clean trash dumpster. Contact waste generated within radiological control areas will be disposed of in a designated radiological contact waste container.

5.5.3 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have approval by the designee and quality assurance representative prior to implementation. In accordance with Section 15.3 of the SCQ, the completed Variance/Field Change Notice must be approved by quality assurance within one week of verbal approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members, included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the media-specific plan.

5.5.4 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this media-specific plan. Safety meetings will be conducted prior to beginning field work to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed applicable training.

For areas that are subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a radiation work permit.

5.5.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2001 and 2002 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying media-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with media-specific plan-specified ASLs. Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. For sediment in 2001 and 2002, field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives. In general, ASL B is appropriate for laboratory generated data collected in 2001 and 2002, because the data are being used for surveillance during site restoration. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

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5.5.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ and FEMP Quality Assurance Program (RM-0012) requirements.

A quality assurance assessment or surveillance shall be performed on tasks specified in the media-specific plan during one of the two annual sediment sampling events conducted under this revision of the IEMP (Revision 2). This assessment may be in the form of an independent assessment or a self-assessment. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

5.6 IEMP SEDIMENT MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP sediment sampling program in 2001 and 2002. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated sediment data to be reported in IEMP annual integrated site environmental reports is provided.

5.6.1 Data Evaluation

Data resulting from the IEMP sediment program will be evaluated to meet the program expectations identified in Section 5.4.1. Based on these expectations, the following questions will be answered through the sediment data evaluation process, as indicated:

- Have changes in the residual contaminant concentrations occurred in sediments found in the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River as a result of runoff and treated effluent from the site?

Data evaluation will consist of basic statistical analysis, such as minimum, maximum, and mean, and comparison to historical data and FRLs. This evaluation will identify long-term trends of targeted radiological constituents in sediment to determine if the potential exists for an FRL exceedance in the future due to FEMP remediation activities. Due to the elimination of four off-site sample locations (initiated in 1999) in lower Paddys Run and the Great Miami River, the Paddys Run data will be evaluated to determine if total uranium concentrations consistently remain low in comparison to previous years. If the results indicate a significant increase in concentrations, then the four locations will be sampled in the same calendar year. As indicated in Figure 5-3, results of the data interpretation will be communicated to project personnel to implement appropriate actions, as necessary.

- Should the sediment program be refined in scope as remediation progresses?

Data evaluation to determine if the IEMP sediment program should be revised will be based on comparison to historic ranges. If data exceeds historical ranges, then program modifications will be considered.

Data evaluation to address any remaining expectations identified in Section 5.4.1 is encompassed in the data evaluation techniques described above.

- Are community concerns being met through the sediment IEMP program?

The IEMP fulfills the needs of the Fernald community by preparing sediment environmental results in annual integrated site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center, which is located a half mile south of the FEMP on Oakridge Drive in the Delta Building. The specific community concern of the magnitude of FEMP discharges to Paddys Run and the Great Miami River is addressed in IEMP annual integrated site environmental reports in the sediment section.

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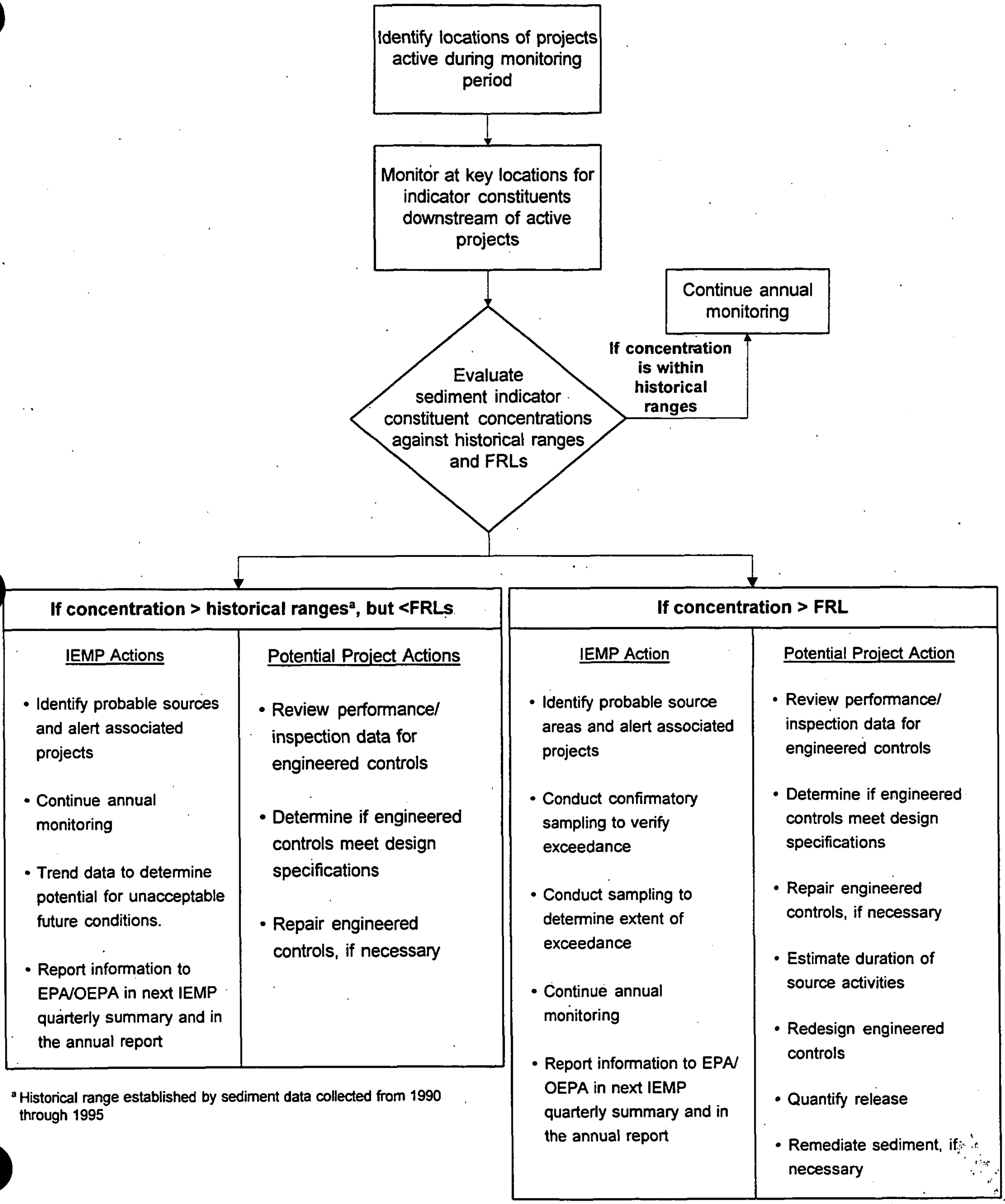
FIGURE 5-3
IEMP SEDIMENT DATA EVALUATION AND ASSOCIATED ACTIONS



[a] Historical range established by sediment data collected from 1990 through 1995

I:\IEMP-NEW\2000\10-00\FIGURES\2000FIG5-3.VSD

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Are the program and reporting requirements of DOE Order 5400.1 being met?

- DOE Order 5400.1 requires that DOE-FEMP implement and report on an environmental protection program for the FEMP. The sediment monitoring program is one component of the sitewide IEMP monitoring program. This IEMP and annual integrated site environmental reports fulfill the requirements of this DOE Order.

5.6.2 Reporting

The IEMP sediment program data will be reported in the form of a Data Extranet Site (the IEMP Data Information Site), quarterly summaries, and annual integrated site environmental reports. Additional information on IEMP data reporting is provided in Section 8.3.3.

Data pertaining to the IEMP sediment monitoring program will be provided on an Extranet Site. The data will be in the format of searchable data sets and/or downloadable data files. This site will be updated every two to four weeks, as data become available.

The IEMP quarterly summary will supplement the Extranet Site by providing a brief summary of the data added to the site that quarter and identifying notable results and/or events related to that data. The IEMP quarterly summaries will be submitted at approximately 30 days from the end of the quarter.

The IEMP annual integrated site environmental reports will be issued each June. The comprehensive report will discuss a year of IEMP data previously reported on the Extranet Site and in the quarterly summaries. The IEMP annual integrated site environmental reports will include the following:

- An annual summary of data from the IEMP sediment monitoring program
- Graphical presentation of data trends over time at each sample location
- Statistical summary by constituent (i.e., minimum, maximum, and mean) by location
- Summary-level information on the effectiveness of the project-specific sediment control structures (to include sediment control efficiency data, if necessary for interpretation of sitewide impacts).

If necessary, sediment results will be presented prior to the submittal of annual integrated site environmental reports to the U.S. Environmental Protection Agency (EPA) and OEPA if significant changes in sediment contaminant concentrations are evident.

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Because the IEMP is a "living document," a structured schedule of annual reviews and two-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any sediment program modifications (i.e., changes in constituents, locations or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

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Section 6.0

6.0 AIR MONITORING PROGRAM

Section 6.0 discusses the monitoring strategy for assessing the sitewide impact of the Fernald Environmental Management Project's (FEMP's) remediation activities on the air pathway. The strategy identifies the activities conducted to satisfy requirements for particulate, radon, and direct radiation monitoring. A media-specific plan for conducting sitewide and off-property air monitoring activities is provided, along with a plan for reporting air-related activities.

6.1 INTEGRATION OBJECTIVES FOR AIR

Unlike the groundwater and surface water programs (which combine a variety of existing compliance and reporting programs together under the Integrated Environmental Monitoring Plan [IEMP] umbrella), the sitewide air pathway has historically been evaluated under two closely knit programs:

- The Fernald Site Environmental Monitoring Plan (FERMCO 1995), which provided physical air monitoring at the K-65 Silos, FEMP property boundary, and critical off-property locations of concern to FEMP stakeholders
- The 40 Code of Federal Regulations (CFR) 61, Subpart H National Emissions Standards for Hazardous Air Pollutants (NESHAP) air pathway dose assessment program which provides calculated estimates of the FEMP's radiological impacts beyond the fenceline to comply with Clean Air Act provisions.

The information produced by these two FEMP programs was reported together in the FEMP's annual site environmental reports that historically satisfied U.S. Department of Energy (DOE) Orders 5400.1 and 5400.5 environmental monitoring and total dose assessment obligations. The NESHAP calculated dose estimates were also reported to the U.S. Environmental Protection Agency (EPA) as a stand-alone report to satisfy the requirements of 40 CFR 61, Subpart H. The IEMP will continue with the responsibility of physically monitoring the air pathway and providing dose assessments to satisfy 40 CFR 61, Subpart H, and the requirements of DOE Orders.

This plan presents an alternate, monitoring-based approach for demonstrating compliance with the requirements of 40 CFR 61, Subpart H. This approach is a fundamental change in the technical basis used for demonstrating compliance with Subpart H, which has been historically accomplished through computer modeling, as described in 40 CFR 61.93 (a). The change to a monitoring based approach reflects the nature of emission sources expected during remediation activities. During the production years at the facility, emissions were primarily from point sources (i.e., stacks and vents), where direct, continuous measurements of point source emission rates and contaminant concentrations served as direct inputs to the Clean Air Act Assessment Package 1988 dispersion model used for demonstrating NESHAP

Subpart H compliance. As remediation activities are initiated, the primary emission sources will be fugitive emissions resulting from a diverse range of activities including building decontamination and dismantling, large scale excavations, material handling, and waste processing operations. It is difficult to predict or measure emissions from such diffuse sources with certainty. Monitoring at the facility fenceline will provide a direct integrated measure of the environmental impact resulting from the full range of planned remediation activities at the FEMP, and therefore, provide a reliable, accurate assessment of dose received by off-site receptors via the air pathway.

The design of the air monitoring program for 2001 and 2002 was developed in recognition of the potential major sources of emissions expected to be active during this time period. These activities include:

- Construction and waste placement activities associated with Cells 1, 2, and 3 of the on-site disposal facility
- Waste excavation, processing and load-out operations associated with Operable Unit 1
- Radon emissions from the silo area
- Construction and startup of Silo 3 operations
- Construction and operations of the Silos 1 and 2 Accelerated Waste Retrieval Project
- Demolition activities associated with plant complexes 2, 3, 5, 6, and 8, and other structures within the former production area
- Excavation activities in the southern waste units and Area I Phase 2 (east/southeast portion of the site).

The focus of the program will be to monitor the collective sitewide effects of remediation activities occurring in 2001 and 2002. The results will be evaluated on a continual basis to provide necessary feedback to the projects to ensure that cumulative sitewide impacts remain below established thresholds. Ultimately, this information will assist in tracking trends during remediation to help identify changes needed in the air monitoring program emphasis and/or design. A reporting plan is provided in Section 6.6 to combine the results of the air monitoring program and the NESHAP dose assessments into a single reporting mechanism to facilitate regulatory agency review of the sitewide remediation activities and associated emission controls. Appendix C outlines the FEMP's plan for demonstrating NESHAP Subpart H compliance and producing required dose assessments during remediation.

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6.2 ANALYSIS OF REGULATORY DRIVERS, DOE ORDERS, AND OTHER FEMP-SPECIFIC AGREEMENTS

The intent of this section is to identify the pertinent regulatory requirements, including applicable or relevant and appropriate requirements (ARARs) and to be considered-based requirements, for the scope and design of the air monitoring program. These requirements will be used to confirm that the program satisfies the regulatory obligations for monitoring that have been activated by the FEMP's record of decisions and will achieve the intentions of other pertinent criteria, such as DOE Orders and the FEMP's existing agreements, as appropriate that have a bearing on the scope of air monitoring.

The results of the evaluation are also used to define the programmatic boundaries between the sitewide IEMP responsibilities and the project-specific emissions-control monitoring conducted by the individual project organizations. It is important to note that during the active uranium production years, the historical Environmental Monitoring Plan also monitored source emissions as part of its broad air effluent responsibility. Now these former Environmental Monitoring Plan source characterization responsibilities reside within the scope of individual remediation projects.

6.2.1 Approach

The analysis of the additional regulatory drivers and policies for air monitoring was conducted by identifying the suite of ARARs and to be considered-based requirements in the FEMP's approved Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) record of decisions and FEMP legal agreements that contain specific air monitoring requirements. This subset was then further divided to identify those monitoring requirements with sitewide implications (and which, therefore, fall under the scope of the IEMP) and those which pertain to emission controls/emission control monitoring that would be the responsibility of the individual remediation projects.

6.2.2 Results

The following regulatory drivers were found to govern the technical scope and reporting requirements for the IEMP's sitewide air monitoring program, and include:

- DOE Order 5400.1, General Environmental Protection Program, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine effluent monitoring and environmental surveillance activities of the facility. The FEMP's Environmental Monitoring Plan provided the initial basis for the development of the IEMP strategy that is responsive to the changing site mission and associated remediation needs while still complying with DOE Orders.

- DOE Order 5400.5, Radiation Protection of the Public and Environment, which establishes radiological dose limits and guidelines for the protection of the public and environment. Under this requirement, the exposure to members of the public associated with activities from DOE facilities from all pathways must not exceed, in one year, an effective dose equivalent of 100 millirem (mrem). For radiological dose due to airborne emissions only, the DOE Order requires compliance with the 40 CFR 61, Subpart H limit of an effective dose equivalent of 10 mrem/year to a member of the public. Demonstration of compliance with this standard is to be based on an air monitoring approach. The DOE Order also provides guidelines for radionuclide concentrations in air, known as Derived Concentration Guides, and radon concentration limits for interim storage of sources during remediation. These radon limits are 100 picoCuries per liter (pCi/L) at any given point, 30 pCi/L annual average sitewide, 3 pCi/L annual average above background at the facility fenceline, and 20 picoCuries per square meter per second (pCi/m^2/sec) flux rate for storage of radon generating wastes (per 40 CFR 61, subpart Q). The guidance document associated with this DOE Order (DOE 1991) recommends confirmatory air monitoring surveillance, which was previously conducted under the Environmental Monitoring Plan and is incorporated into the IEMP.

- Proposed 10 CFR 834, DOE Facilities Radiation Protection of the Public and Environment, which is similar in intent to DOE Order 5400.5. However, differences include the deletion of the 100 pCi/L limit and 30 pCi/L annual limit, lowering the fenceline limit to 0.5 pCi/L above background, changes to facility and facility boundary definitions, and clarifications to the definition of point of compliance. Because this is only a proposed rule, these limits are to be used as guidelines and should not override the requirements of DOE Order 5400.5. When the rule is promulgated, a compliance strategy will be developed to accommodate the FEMP's site-specific circumstances relative to meeting the new standards.

- NESHAP 40 CFR 61, Subpart H, which provides national emissions standards for radionuclides other than radon. Per this requirement, emissions of radionuclides (excluding radon) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent in excess of 10 mrem/year. Demonstration of compliance with this standard is to be based on an air monitoring approach.

- Federal Facility Agreement (FFA), Control and Abatement of Radon-222 Emissions, signed November 19, 1991, which ensures that DOE takes all necessary actions to control and abate radon-222 emissions at the FEMP. This agreement acknowledges that the K-65 Silos (Operable Unit 4) exceed the radon emission of 20 pCi/m^2/sec, but allows the FEMP to address this exceedance by implementing a removal action to bring radon emissions from the silos to a level as low as reasonably achievable, and to attain the NESHAP Subpart Q standard upon completion of final remediation. The removal action work plan included a radon monitoring system, which was previously monitored under the predecessor Environmental Monitoring Plan, and is now incorporated into the IEMP. The FFA also requires demonstration of compliance with the Subpart Q standard (upon completion of remedial actions) for the waste pits, clearwell, and any other sources found to emit radon in excess of 20 pCi/m^2/sec.

- DOE Order 5820.2A Chapter III.3.k, Environmental Monitoring, which requires low-level radioactive waste disposal facilities to perform environmental monitoring that meets requirements in DOE Order 5400.1 for all media, including the air pathway. This requirement applies to the on-site disposal facility, as it is the only disposal facility at the FEMP. Instead of a separate monitoring plan for the on-site disposal facility, the air monitoring program for the on-site disposal facility will be integrated and incorporated into the IEMP's air monitoring program.

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Upon evaluating the IEMP ARARs in consideration of protection of human health and/or the environment, the 10 mrem/year dose limit was determined to be the most stringent emission limit. Therefore, the 10 mrem/year NESHAP standard provides a reasonable benchmark for ensuring compliance with all other air standards (excluding radon) and ensuring an adequate level of protectiveness.

Twelve other regulatory drivers have air-monitoring implications, of a project-specific emissions-control nature, which fall outside the scope of the IEMP. These requirements pertain to the monitoring of fugitive area emission controls and the monitoring of point source emissions. The project-specific air monitoring drivers for fugitive dust include:

- Permit to Install New Sources, Criteria for Decision by Director, Ohio Administrative Code (OAC) 3745-31-05(A)(3), which requires the use of Best Available Technology (BAT) when installing, modifying, and operating an air contaminant source. The BAT Determination for Remedial Construction Activities on the FEMP provides a method for using BAT as it applies to fugitive dust sources.

- Ohio General Provisions on Air Pollution Control, Air Pollution Nuisances Prohibited, OAC 3745-15-07 and Ohio Revised Code (ORC) 3704.01-.05, which prohibits the emission or escape into the open air of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, and odors in such amounts that may cause a public nuisance. Control of such emissions is the responsibility of the projects through source control, as described in the BAT Determination for Remedial Construction Activities on the FEMP.

- Ohio Emissions of Particulate Matter, Restriction of Emission of Fugitive Dust, OAC 3745-17-08, which provides for the restriction of emission of fugitive dust by the use of control measures. Such control measures include, for example, water or dust suppression chemicals for control of fugitive dust from demolition of buildings or on dirt or gravel roads, the use of hoods or fans to enclose and control fugitive dust, and the use of canvas or other coverings for stockpiles. During 1997, DOE and the Ohio Environmental Protection Agency (OEPA) negotiated a BAT determination that established control measures, emission standards, and record keeping requirements for the control of fugitive dust from roads (paved and unpaved), material storage piles, parking areas, and construction areas. This BAT determination has been approved by OEPA and is contained in procedure RM-0047.

The project-specific regulatory drivers for point and other sources include:

- NESHAP 40 CFR 61, Subpart Q, which provides national emissions standards for radon. The standard for this regulation is that no source at a DOE facility shall emit more than 20 pCi/m^2/sec of radon-222, as an average for the entire source, into the air. A source is defined in the regulation as any building structure, pile, impoundment, or area used for storage or disposal that contains sufficient quantities of radium so as to exceed the standard. To demonstrate compliance with the standard, radon monitoring is conducted at the source. Such source monitoring, with the exclusion of that conducted at the K-65 Silos, will be addressed within project remedial design and remedial action documents. The K-65 Silo monitoring will be conducted under the IEMP.

- NESHAP 40 CFR 61, Subpart H, which provides national emissions standards for radionuclides other than radon. Per this requirement, emission measurements shall be made at point sources with a potential to discharge radionuclides into the air in quantities which could cause an effective dose equivalent in excess of one percent of the standard (10 mrem/year).

- Ohio Particulate Matter Standards, Restrictions on Particulate Emissions from Industrial Processes, OAC 3745-17-11, which describes emission restrictions for particulates from industrial processes. These restrictions apply to operations, processes, or activity other than those subject to fugitive dust regulations in OAC 3745-17-08 (discussed above), and are therefore applicable to process units..

- Particulate Matter Standards, Control of Visible Emissions from Stationary Sources, OAC 3745-17-07(A), which sets visible particulate emission limitations for stacks. Visible particulate emissions from any stack cannot exceed 20 percent opacity, as a six-minute average.

- Air Quality Standards, Control of Emissions of Organic Materials from Stationary Sources, OAC 3745-21-07(G)(2), which sets a discharge limit of 40 pounds of organic material per day, and no more than eight pounds per hour, for any article, machine, equipment, or other contrivance used for applying, evaporating, or drying and photochemically reactive material unless the discharge has been reduced by at least 85 percent.

- Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Miscellaneous Units, 40 CFR 264.601 through .603, and OAC 3745-57-91 through 93, which requires that miscellaneous units be designed, operated, and maintained to prevent releases to the air pathway. Monitoring may be necessary to evaluate the effectiveness of air emission controls. Operable Unit 1 remedial actions may require the use of miscellaneous units for the management or treatment of Resource Conservation and Recovery Act-regulated hazardous waste.

- Permit to Install New Sources, Criteria for Decision by Director, OAC 3745-31-05(A)(3), which requires the use of BAT when installing, modifying, and operating an air contaminant source. Any treatment units for remediation activities will be designed to include BAT.

- General Provisions on Air Pollution Control, Malfunction of Equipment, Scheduled Maintenance, Reporting, OAC 3745-15-06(A)(1) and (2), which requires scheduled maintenance of air pollution control equipment in order to prevent a malfunction. Shutdown of the operating unit, if required to conduct the maintenance, must be accompanied by the shutdown of the associated air pollution sources. Project-specific remedial design and remedial action work plans will include a maintenance program to address this requirement.

Ohio Standards for Active and Inactive Asbestos Disposal Sites, OAC 3745-20-06 and OAC 3745-20-07(A) and (C), which prohibit visible emissions of asbestos during and after placement. Asbestos management is primarily limited to asbestos removal conducted prior to building demolition and disposal either off-site or in the on-site disposal facility. The visible emission standard for asbestos is closely tied to asbestos management, and is not within the scope of the IEMP.

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Table 6-1 lists all of the above requirements and includes each of the air monitoring regulatory requirements to be conducted under the IEMP and the associated monitoring designed to comply with each requirement. Table 6-1 also lists each regulatory driver for project-specific air monitoring, the monitoring conducted to meet the requirement, and the project-specific plan that will describe the monitoring program. Sections 6.6 and 8.0 outline the FEMP's current and long-range plan for complying with the reporting requirements invoked by the IEMP regulatory drivers.

6.3 BOUNDARY DEFINITION

This section identifies the programmatic boundary(s) established between the IEMP and the project-specific activities. The intent behind the boundary definition is to clearly delineate the scope of the IEMP's monitoring responsibility and establish a recognized interface between the sitewide focus of the IEMP and the fugitive and point source emission-control focus of the project-specific monitoring.

In general, the program boundaries for air monitoring are defined in the following two fundamental areas:

Fugitive Emissions Monitoring

As stated earlier, the air monitoring program presented in the IEMP will serve as the vehicle for demonstrating compliance with the NESHAP Subpart H limit ensuring that no member of the public receives an effective dose equivalent in excess of 10 mrem/year from radionuclide emissions (excluding radon) as a result of FEMP operations. As such, the air monitoring approach presented in this plan will provide a continual measurement of the collective effectiveness of fugitive and point source emissions from the site relative to this health protective standard. Each project is responsible for controlling fugitive dust to comply with the BAT determination for the FEMP. The standards and control techniques are provided in procedure RM-0047, which has been approved by OEPA. Procedure RM-0047 outlines the administrative and engineered controls for mitigating fugitive dust. Additional air monitoring at the project level to determine the effectiveness of specific administrative and engineered controls for fugitive dust abatement (above those required under the BAT determination) are not necessary to ensure protection of the public or support compliance with NESHAP, Subpart H. However, the air monitoring information maintained by the projects will be used as necessary to support the data interpretations conducted through the IEMP. Likewise, the air monitoring data collected through the IEMP will be used to provide continual feedback to the remediation projects on the effectiveness of emission controls.

TABLE 6-1

FEMP MONITORING PROGRAM
REGULATORY DRIVERS AND RESPONSIBILITIES

	DRIVER	ACTION
IEMP	DOE Order 5400.1, General Environmental Protection Program Environmental Monitoring Plan for all media	The IEMP describes effluent and surveillance monitoring as required by DOE Order 5400.1.
	DOE Order 5400.5, Proposed 10 CFR 834 Radiation Protection of the Public and Environment	The IEMP describes on-site and off-site monitoring for radon and other radionuclides and monitoring to determine annual dose from the air pathway.
	NESHAP 40 CFR 61, H Emission Standards for Radionuclides (excluding radon)	The IEMP includes an assessment of the annual dose to the public from the air pathway by employing a fenceline monitoring program.
	Federal Facility Agreement Control and Abatement of Radon-222 Emissions	The IEMP includes radon monitoring at the Operable Unit 4 Silos and the Operable Unit 1 waste pits.
	DOE Order 5820.2A, Environmental Monitoring for Low-Level Radioactive Waste Disposal Facilities	The IEMP fenceline air monitoring includes air monitoring at locations adjacent to the on-site disposal facility.

TABLE 6-1
(Continued)

	DRIVER	ACTION	PROJECT PLAN
PROJECT	NESHAP 40 CFR 61, Q Emission Standards for Radon for Storage and Disposal Units or Areas	Radon flux monitoring at Operable Unit 1 and Operable Unit 4 storage and disposal units as applicable to ensure compliance with the standard	Operable Unit 1 Remedial Design/Remedial Action Documents Package; Operable Unit 4 Remedial Design Packages
	OAC 3745-17-11, Ohio Particulate Matter Standards Industrial Processes	Visible emission monitoring for Operable Unit 1 waste pit treatment unit stacks/vents and Operable Unit 4 treatment units, as determined necessary to ensure compliance with the standard	Operable Unit 1 Remedial Design/Remedial Action Documents Package; Operable Unit 4 Remedial Design Packages
	40 CFR 264.601-.603; OAC 3745-57-91 through 93 Miscellaneous Hazardous Waste Management Units	Monitoring at vents/stacks at Operable Unit 1 hazardous waste treatment of storage units, as determined necessary by modeling	Operable Unit 1 Remedial Design/Remedial Action Documents Package
	OAC 3745-31-05(A)(3), BAT for New Air Sources	Air monitoring at stacks/vents for Operable Unit 1 and Operable Unit 4 treatment units, as determined necessary to ensure compliance with the standard	Operable Unit 1 Remedial Design/Remedial Action Documents Package; Operable Unit 4 Remedial Design Packages

TABLE 6-1
(Continued)

	DRIVER	ACTION	PROJECT PLAN
PROJECT - FUGITIVE DUST CONTROL	OAC 3745-17-07(a), Ohio Particulate Matter Standards Visible Particulate Emissions for Stacks	Visible emission monitoring for Operable Unit 1 waste pit treatment unit stacks/vents and Operable Unit 4 treatment units, as determined necessary to ensure compliance with the standard	Operable Unit 1 Remedial Design/Remedial Action Documents Package; Operable Unit 4 Remedial Design Packages
	OAC 3745-21-07(G)(2), Ohio Air Quality Standards for Organics	Air monitoring at stacks/vents for Operable Unit 1 treatment units, as determined necessary by modeling	Operable Unit 1 Remedial Design/Remedial Action Documents Package
	OAC 3745-31-05(A)(3), BAT for New Air Sources	Visible emission monitoring for roadways and parking areas and storage piles associated with the Operable Unit 1 waste pits, soil excavation, and on-site disposal facility projects and other construction activities as determined necessary to ensure compliance with the standard	BAT Determination for Remedial Construction Activities at the FEMP
	OAC 3745-15-07; ORC 3704.01-.05, Ohio General Provisions on Air Pollution Control, Prohibition of Public Nuisance	Visible fugitive emission monitoring for waste pit excavation, soil excavation areas, and on-site disposal facility construction and waste placement as determined necessary to ensure compliance with the standard	BAT Determination; Sitewide Excavation Plan
	OAC 3745-17-08, Ohio Emissions of Particulate Matter Control of Emissions of Fugitive Dust	Visible fugitive emission monitoring for waste pit excavation, soil excavation areas, and on-site disposal facility construction and waste placement as determined necessary to ensure compliance with the standard	BAT Determination; Sitewide Excavation Plan; On-Site Disposal Facility Impacted Materials Placement Plan, and Borrow Area Management and Restoration Plan
	OAC 3745-17-07(B)(4) through (6), Ohio Emissions of Particulate Matter Roadways, Parking Areas, and Storage Piles	Visible emission monitoring for roadways, parking areas, and storage piles associated with the Operable Unit 1 waste pits, soil excavation, and on-site disposal facility	BAT Determination; Operable Unit 1 Remedial Action Documents Package; Site-Wide Excavation Plan

Point Source Monitoring

Point source monitoring (i.e., stacks and vents) is designated as a project responsibility due to the direct emission and process control nature of this monitoring activity. The technical approach and design of stack monitoring systems will be an integral part of the process control scheme and overall system design for future remediation treatment units. The data collected from stack monitoring systems will provide critical information that will serve as process control feedback on unit operations. As such, the individual remediation project responsible for the process must maintain responsibility for the monitoring system design and operation. However, as discussed in Section 1.0, the data collected from point source emissions will be integrated into the IEMP reporting framework as necessary to support sitewide data interpretations.

6.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

6.4.1 Program Expectations

The IEMP air monitoring program has been designed to collect data sufficient to meet the following expectations for 2001 and 2002:

- Provide a program that will provide a continual assessment of the collective emissions accompanying multiple concurrent remediation projects at the FEMP and provide necessary early warning feedback regarding the cumulative sitewide effectiveness of project-specific emission controls relative to applicable protective health standards
- Provide monitoring data sufficient to demonstrate compliance with 40 CFR 61, Subpart H, requirements ensuring that no member of the public receives an annual effective dose equivalent in excess of 10 mrem
- Provide data sufficient to determine compliance with the radon concentration limits of DOE Order 5400.5
- Provide measurements of direct radiation sufficient to support the annual dose assessment calculations required by DOE Order 5400.5 accounting for all significant exposure pathways
- Provide a program that promotes the continued confidence of the public and is responsive to concerns raised by stakeholders regarding forthcoming remediation activities
- Provide a program capable of assessing trends from year to year so that necessary modifications or adjustments in program focus can be accommodated.

6.4.2 Program Design

The air monitoring program is comprised of three distinct components:

- Radiological air particulate monitoring
- Radon monitoring
- Direct radiation monitoring.

Each component of the sitewide air monitoring program is designed to address a unique aspect of air pathway monitoring, and as such, reflects distinct sampling methodologies and analytical procedures. The following sections and Appendix C provide a detailed discussion on the design of the IEMP air monitoring program.

6.4.2.1 Radiological Air Particulate Monitoring Design Summary

The radiological air particulate monitoring program for 2001 and 2002 is designed to fulfill the following primary program expectations:

- Provide a continual assessment of the collective emissions accompanying multiple concurrent remediation projects at the FEMP and provide necessary early warning feedback regarding the cumulative sitewide effectiveness of project-specific emission controls relative to the health protective NESHAP standard of 10 mrem
- Provide sufficient monitoring data to demonstrate compliance with 40 CFR 61, Subpart H requirements ensuring that no member of the public receives an annual effective dose equivalent of 10 mrem.

To meet these expectations, the program design is based on taking direct measurements of radionuclide concentrations in the environment at the facility fenceline and at background locations (Figure 6-1). A network of 19 high volume air monitoring stations have been established, based on the location of potential off-site receptors and in consideration of the 16 primary wind rose sectors (Figure 6-2). The monitoring network encompasses all the current and expected diffuse and point sources at the FEMP. Because the point of compliance under NESHAP Subpart H is the receptor location, monitoring locations are designated at the FEMP property boundary in wind rose sectors where potential receptors are immediately located adjacent to the property boundary (primarily in the south and west). In sectors where the closest potential receptors are located away from the FEMP property boundary (primarily northwest and east), monitors are designated at the FEMP property boundary in line with these receptor locations. The Environmental Regulatory Guide for Radiological Effluent Monitoring (DOE 1991) and EPA siting criteria (40 CFR 58, Appendix E) were considered when selecting these locations.

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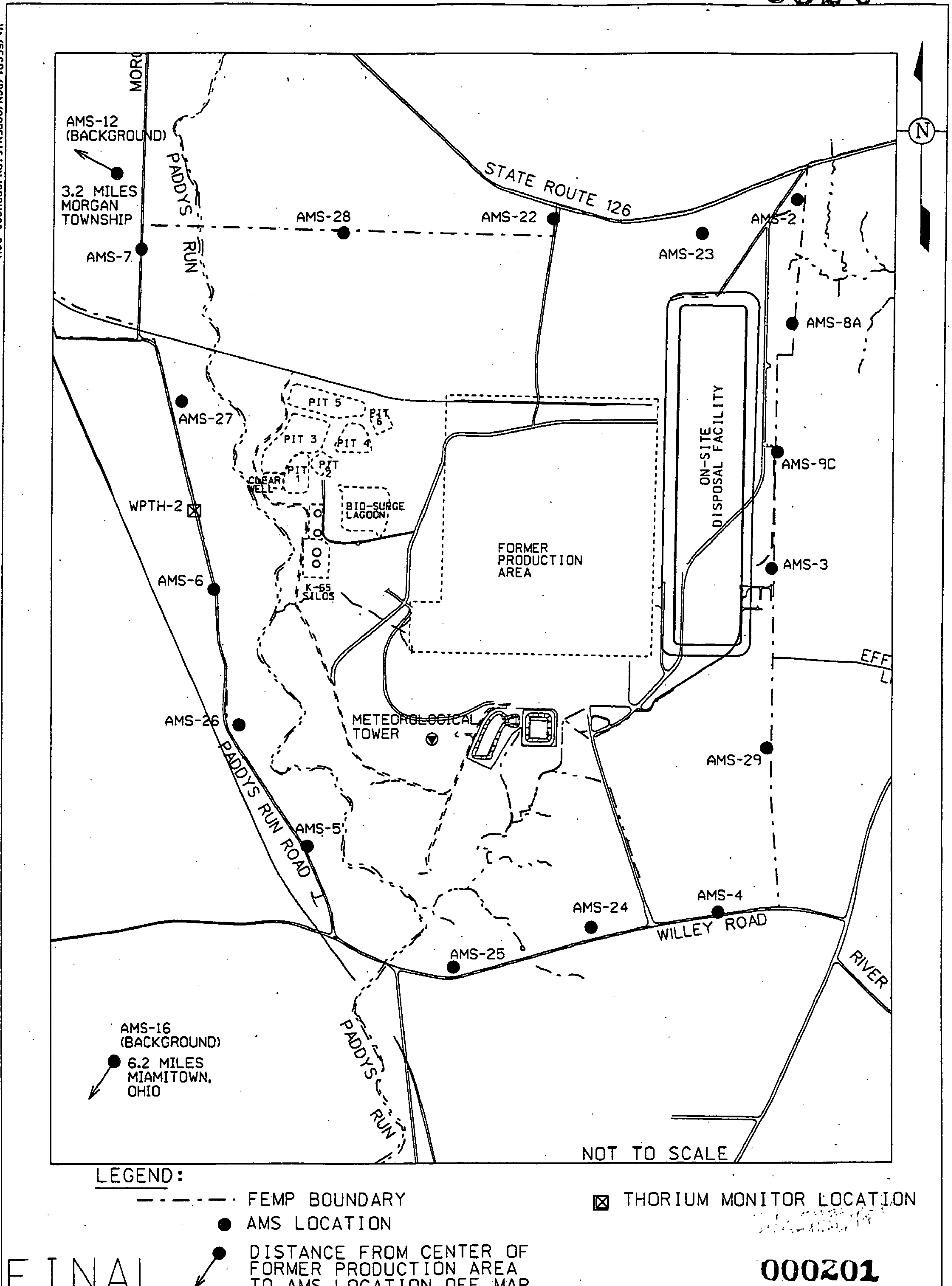

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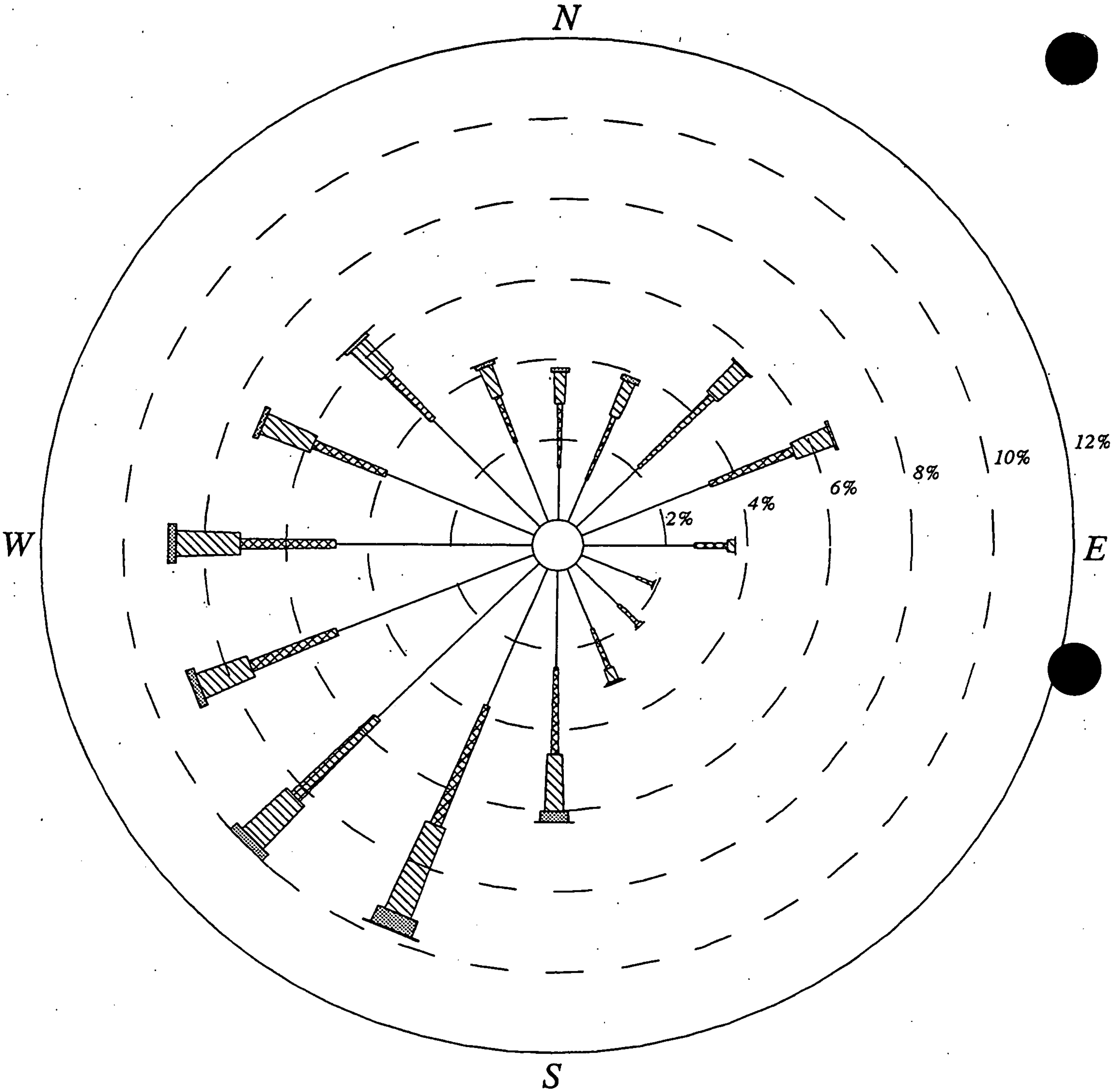
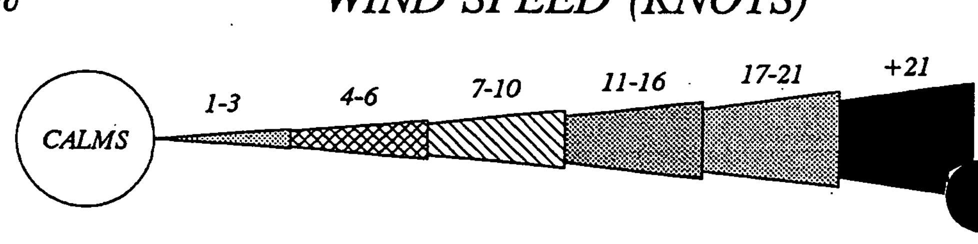
FIGURE 6-1. IEMP AIR MONITORING LOCATIONS

FEMP 95-99 (10m level)



CALM WINDS 7.02%



NOTE: Frequencies indicate direction from which the wind is blowing.

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FIGURE 6-2. AVERAGE FEMP WIND ROSE DATA, 1995-1999

The analytical regime and sampling frequency for this program is designed to meet the following two fundamental criteria:

- Provide routine analysis that supports a timely evaluation of the effectiveness of sitewide emission controls
- Account for the major contributors to dose as defined in 40 CFR 61.93(b)(5)(ii) for the purposes of demonstrating NESHAP Subpart H compliance.

Based on these criteria, the analytical regime and sampling frequency for the radiological air particulate monitoring program for 2001 and 2002 consists of the following:

- Biweekly Uranium and Total Particulate Samples

  Filters will be exchanged biweekly at all air monitoring stations (AMS). AMS-2 through AMS-29 will be analyzed for total uranium and total particulate. The data will provide the basis for conducting an ongoing assessment of the effectiveness of sitewide emission controls. The results of this assessment will be provided to the remediation projects on a routine basis as feedback to support timely project decision making as necessary. Section 6.6 presents the data evaluation process. Uranium represents the most pervasive contaminant at the site; it can be analyzed quickly, reliably, and inexpensively at the on-site laboratory and is expected to be one of the major contributors to dose (in addition to thorium) based on the remediation activities scheduled over the next two years.

  The total particulate data will be used to evaluate particulate loading on the filters. The particulate loading will be monitored to ensure that acceptable flow-rates are maintained through the filter. If loading becomes excessive due to increased activity at the site and in the surrounding community, then adjustments will be made to the sampling frequency.

- Biweekly Thorium Samples

  During certain remediation projects, thorium may surpass uranium as the major contributor to dose. The Waste Pits Remedial Action Project has the potential to generate particulate emissions containing elevated levels of uranium and thorium. Although thorium isotopes are measured on a quarterly frequency at AMS-2 through AMS-29, more frequent analysis for thorium is judged to be necessary to provide regular monitoring of fenceline thorium levels. Based on fenceline monitoring results from the first and second quarters of 2000, thorium-230 has proven to be the major contributor to air inhalation dose from pit emissions. While the application of administrative and engineering controls for fugitive dust abatement will minimize pit emissions, there is a need to confirm thorium emissions remain at low levels during the excavation of the waste pits. Therefore, AMS-2 through AMS-29 and WPTH-2 filters will be exchanged biweekly and analyzed for thorium (thorium-228, thorium-230, and thorium-232) to provide confirmatory sampling of thorium emissions during excavation of the waste pits. The biweekly thorium monitoring program will utilize the same equipment and data review practices as the uranium and total particulate air sampling program.

The operation of the WPTH-1 monitor, which was co-located with AMS-28, was suspended in October of 2000 with the start of biweekly thorium monitoring at AMS-28.

- Quarterly Composite Sampling

  A portion of each biweekly sample (AMS-2 through AMS-29) will be used to form a quarterly composite sample for each air monitoring station. The quarterly composite samples will be analyzed at an off-site laboratory for the expected major contributors to dose over the next two years, including uranium-238, uranium-235/236, uranium-234, thorium-232, thorium-230, thorium-228, and radium-226. The results of the quarterly composite data will be used to track compliance against the NESHAP Subpart H standard and will serve as the basis for demonstrating annual compliance. The data will also be incorporated into the on-going evaluation of emission controls.

The key isotopes selected for quarterly analysis represent the major contributors to dose based on the following considerations:

- Radionuclides which are stored in large quantities at the FEMP and which will be handled or processed during the remediation effort (uranium, thorium-230, thorium-232, and radium-226)

- Radionuclides which have been the major contributors to dose based on environmental and stack filter measurements (uranium and thorium-230)

- Radionuclides which, due to their concentration in waste and contaminated soil, will be the major contributors to dose if the waste or soil is released in the form of fugitive dust (uranium, thorium-228, and thorium-230).

Additional technical information supporting the analytical regime presented here is provided in Appendix C. Table 6-2 presents a summary of the analytical and sampling information provided above.

TABLE 6-2

SAMPLING AND ANALYTICAL SUMMARY FOR RADIOLOGICAL AIR PARTICULATE AND CONFIRMATORY THORIUM SAMPLES

Locations	Constituent	Sample Matrix	Sample Frequency	Laboratory	ASL[a]	Detection Level	Container
AMS-2 through AMS-29	Total Uranium	Air	Biweekly	On-Site	B	2 µg/filter	20 cm x 25 cm polyester 0.5 µm filter
AMS-2 through AMS-29	Total Particulate	Air	Biweekly	On-Site	A	NA[b]	20 cm x 25 cm polyester 0.5 µm filter
AMS-2 through AMS-29, and WPTH-2	Thorium-228 Thorium-230 Thorium-232	Air	Biweekly	On-Site/ Contract	B E	0.4 pCi/filter	20 cm x 25 cm polyester 0.5 µm filter
AMS-2 through AMS-29	Uranium-234 Uranium-235/236 Uranium-238 Thorium-228 Thorium-230 Thorium-232 Radium-226	Air	Quarterly composite	Contract	E	$9x10^{-5}$ pCi/m^3 $9x10^{-5}$ pCi/m^3 $9x10^{-5}$ pCi/m^3 $7x10^{-6}$ pCi/m^3 $7x10^{-6}$ pCi/m^3 $7x10^{-6}$ pCi/m^3 $2x10^{-4}$ pCi/m^3	0.5 liter amber glass

[a]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[b]NA = not applicable

6.4.2.2 Radon Monitoring Design Summary

The radon monitoring component of the IEMP program is designed to collect environmental radon measurements in order to gauge emissions from radon-generating materials contained on site. The monitoring design is influenced by the radon concentration limits established in DOE Order 5400.5 and satisfies FFA mandated monitoring requirements. Continuous environmental radon monitors collect data representing the short-term fluctuations in radon concentrations. These monitors are placed at various locations on site, at the facility fenceline, and at off-site background locations. The monitoring locations reflect DOE guidance (DOE 1991) for placing environmental samplers. Figure 6-3 depicts the locations of continuous alpha scintillation monitors.

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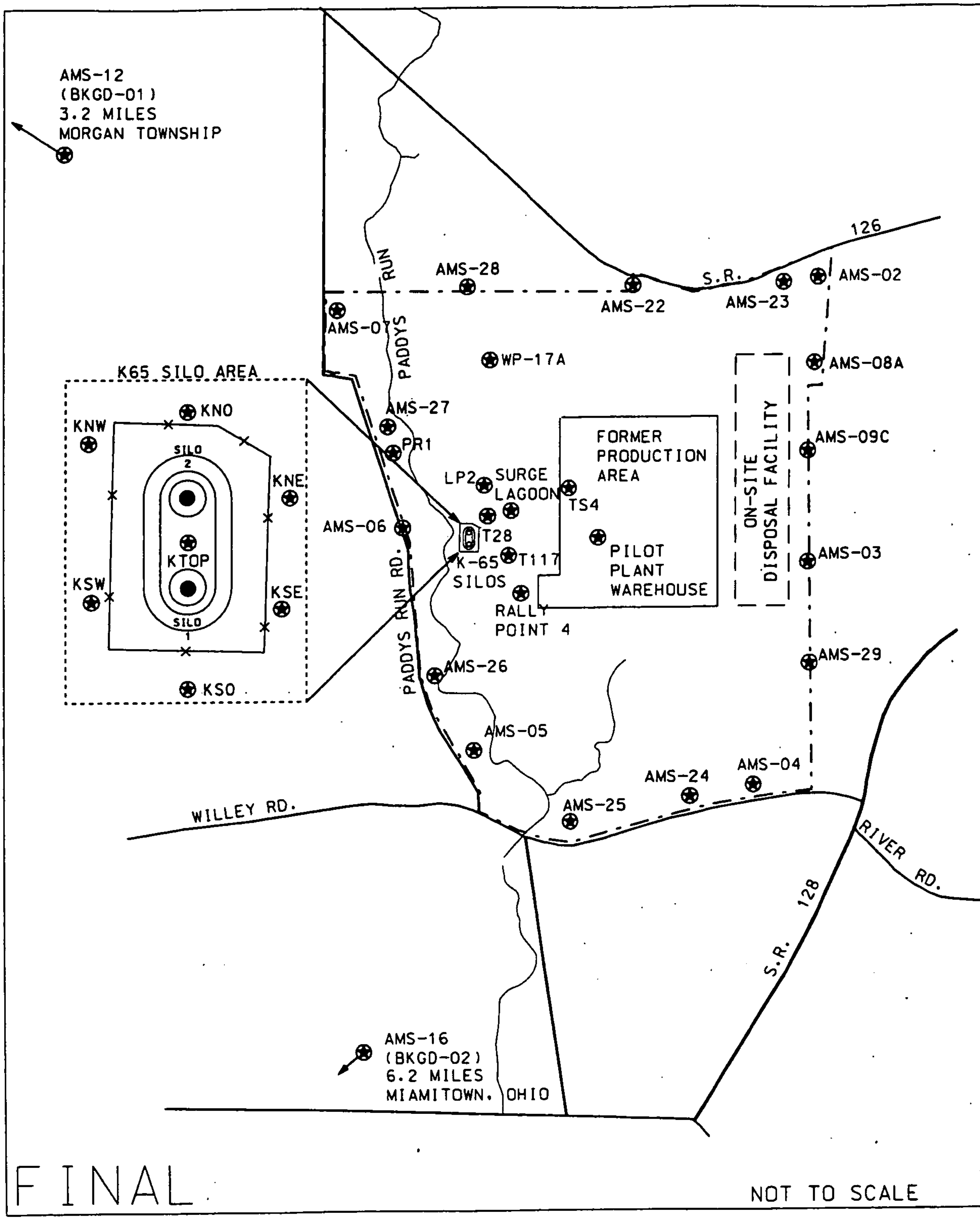

25-AUG-2000

LEGEND:

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ENVIRONMENTAL RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION

DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO LOCATION OFF MAP

SILO HEAD SPACE RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION

000206

FIGURE 6-3. RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATIONS

Data from the monitors are used to assess compliance with the following limits outlined in DOE Order 5400.5:

- 100 pCi/L at any given location and any given time
- Annual average concentration of 30 pCi/L (above background) over the facility
- Annual average concentration of 3 pCi/L (above background) at and beyond the facility fenceline.

To assess the appropriateness of the radon monitoring locations during 2001 and 2002, the current and expected radon sources during this period were evaluated. The sources included the K-65 Silos, Silo 3, the waste dryer, the waste pit material handling building, the railcar loadout building, and the waste pit area. As remediation activities are undertaken at the FEMP, the radon monitoring program may change to ensure effective radon monitoring as a result of changing work activities.

Based on a review of the current and expected radon sources during 2001 and 2002, the monitoring program utilizes a network of 34 continuous environmental radon monitors to measure ambient radon concentrations. Monitors are placed near a variety of sources and are used during site-specific project activities that could release radon. The program is mostly concentrated near the K-65 Silos, waste pit area, and at the facility fenceline. Off-site locations considered outside the influence of the FEMP radon sources are considered for background comparisons. Table 6-3 summarizes the analytical regime for the radon monitoring program.

TABLE 6-3

SAMPLING ANALYTICAL SUMMARY FOR RADON DETECTORS

Constituent	Sample Matrix	Sample Frequency	ASL	Holding Time	Preservative	Detection Level	Detection Method
Radon-222	Air	Continuous/24 hours	A	NA[a]	NA[a]	0.05 to 0.15 pCi/L	Alpha Scint.

[a]NA = not applicable

Locations near the K-65 Silos and the waste pit area fulfill the need to monitor both the instantaneous ambient 100 pCi/L radon limit as well as the 30 pCi/L annual limit for facilities. Program changes included the addition of five environmental radon monitors in the vicinity of the silos to provide additional monitoring of radon levels during the Silo 1 and 2 Accelerated Waste Retrieval Project and subsequent treatment operations for Silos 1, 2, and 3 material. The additional monitors are designated as KNO, KSO, LP2, T117, and PR1 and are shown in Figure 6-3. Other on-site monitors are placed at FFA-mandated locations or established IEMP locations.

Fenceline monitors are co-located with the high volume air particulate samplers; these locations represent the 16 primary wind rose sectors and provide data for determining compliance with the fenceline radon limit of 3.0 pCi/L annual average above background.

The monitors provide feedback of environmental radon conditions on a timely basis (i.e., daily). Hourly data collected from all of the monitors will be summarized on a monthly basis to provide the minimum daily average, maximum daily average, and hourly median concentration for the month.

The instrument background is the combination of the laboratory-determined count rate for a specific electronic instrument (also known as *electronic noise*) and any counts from trace radioactive decay products and impurities found in the scintillation material of the continuous radon monitor as measured in a radon free environment. Instrument background is subtracted from the measurement data prior to comparing data from fenceline and on-site monitors to data from background monitors. Instrument background corrected data will be presented in IEMP quarterly summary reports.

6.4.2.3 Direct-Radiation Monitoring Design Summary

The direct-radiation monitoring component of the IEMP program is designed to collect measurements of environmental radiation levels resulting from radioactive materials on site. This is accomplished using a network of 32 environmental thermoluminescent dosimeters (TLDs). DOE guidance (DOE 1991) and American National Standards Institute (ANSI) recommendations (ANSI 1975) were considered in selecting monitoring locations.

The K-65 Silos are the single largest source of direct (gamma) radiation at the FEMP. Therefore, TLD locations radiate outward from the silo area with emphasis on the nearby and publicly accessible western boundary of the site. Additional TLDs are located at air monitoring stations at the facility fenceline and at background measurement points. Figure 6-4 identifies the TLD monitoring locations.

The network of TLDs provides a mechanism to measure and track ambient radiation levels at the facility fenceline, from gamma emitting radioactive materials (primarily radium-226, thorium-232, and their decay products) that are handled and processed during remediation.

Three individual TLDs are placed at each location in order to assess the precision of the data. The TLDs are placed one meter above the ground and exchanged quarterly in accordance with industry standards and DOE guidance (DOE 1991). The TLDs are processed at the DOE Laboratory Accreditation Program-approved on-site dosimetry laboratory or equivalent vendor laboratory.

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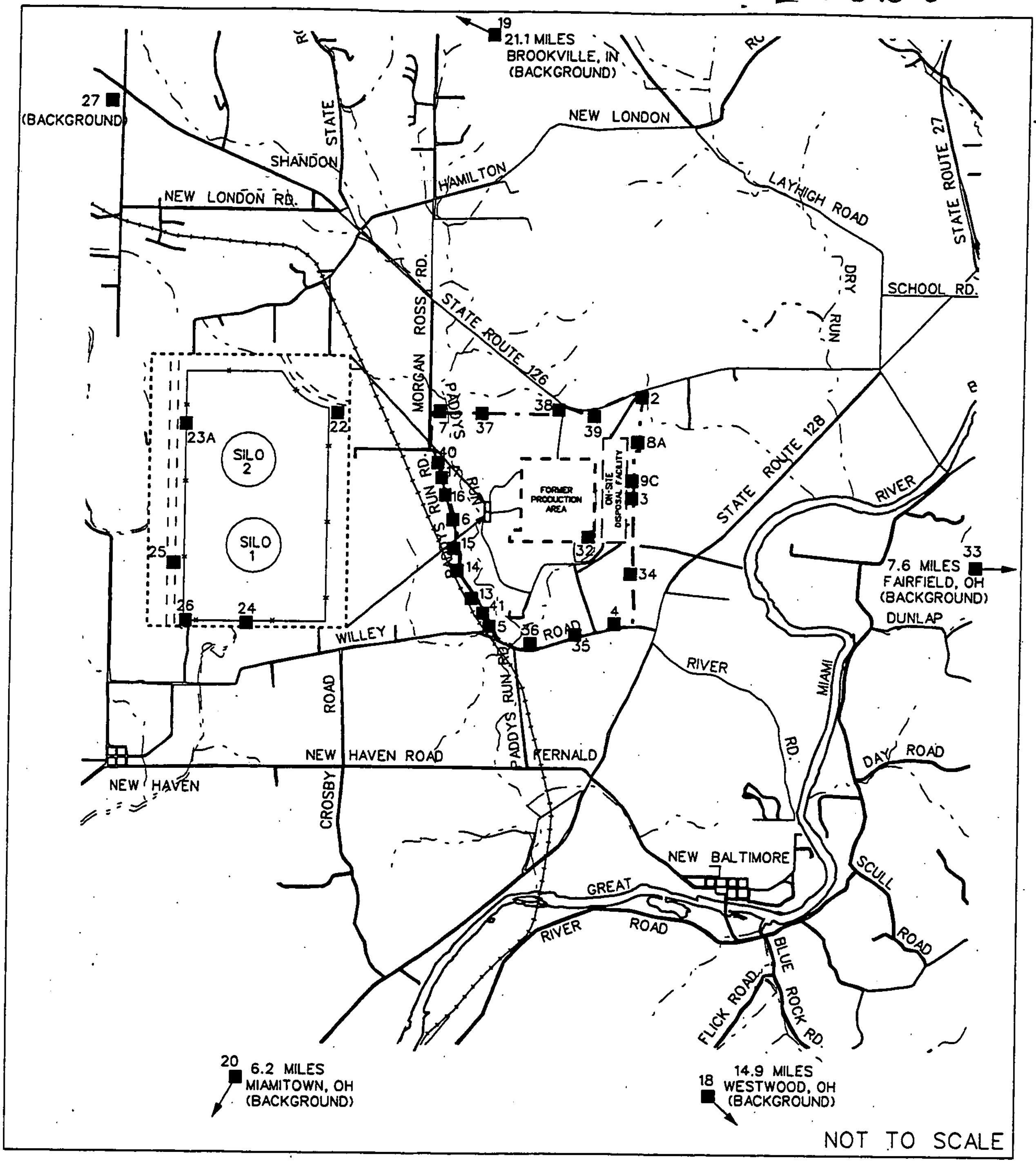

11-24-99

LEGEND:

DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO SAMPLE LOCATIONS OFF MAP

FEMP BOUNDARY

DIRECT RADIATION (TLD) MONITORING LOCATION

FINAL

FIGURE 6-4. DIRECT RADIATION (THERMOLUMINESCENT DOSIMETER) MONITORING LOCATIONS

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Data from the TLDs are used to assess the direct radiation component of the air pathway dose calculation (Appendix C). Table 6-4 summarizes the analytical regime for the direct radiation monitoring program.

TABLE 6-4

ANALYTICAL SUMMARY FOR DIRECT RADIATION (TLD)

Analyte	Sample Matrix	Sample Frequency	ASL[a]	Holding Time[b]	Preservative	Detection Level	Container
Gamma Radiation (TLD)	TLD	Quarterly	B	NA[c]	NA[c]	5 mrem	NA[c]

[a]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[b]TLDs are read soon after collection by on-site laboratory (typically within one week).
[c]NA = not applicable

6.4.2.4 Meteorological Monitoring Program Design Summary

Although not a distinct component of the existing sitewide air monitoring program, the meteorological monitoring program is designed to provide data on the atmospheric conditions which influence the dispersion and transport of contaminants in the air pathway. This program provides critical data for the evaluation and interpretation of air monitoring data. The meteorological monitoring program also supports the design and operation of the IEMP air monitoring program and as such, is presented in this section.

The FEMP meteorological monitoring system consists of a single 60-meter meteorological tower located west of the Storm Water Retention Basin (Figure 6-1). Monitoring instruments record wind speed, wind direction, temperature, barometric pressure, precipitation, relative humidity, and store one-minute and 15-minute average data on the meteorological database. The system has been developed based on the requirements of DOE Order 5400.5 and DOE guidance (DOE 1991) and complies with industry standards for calibration and data recovery.

Meteorological data are used in the evaluation and interpretation of environmental data collected from the air, radon, and project-specific monitoring data. Short-term meteorological data will be used to relate air monitoring results to specific projects, when necessary. For example, if the results from a specific monitor are higher than expected, then the monitoring result would be evaluated using the wind rose developed from meteorological measurements collected during the monitoring period. A remediation project upwind of the monitor during the monitoring period would then be considered a possible source of

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the higher-than-expected results. In addition to supplying data necessary to support monitoring and surveillance, the meteorological monitoring system serves to support the day-to-day operations for construction, emergency preparedness, and engineering design.

6.5 MEDIA-SPECIFIC PLAN FOR SITEWIDE ENVIRONMENTAL AIR MONITORING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the sitewide environmental air monitoring program. The program expectations and design presented in Section 6.4 were used as the framework for developing the monitoring approach presented in this section. The activities described herein were designed to provide environmental data of sufficient quality to meet the intended data use as described in the program design in Section 6.4.2. All sampling procedures and analytical protocols described or referenced in this media-specific plan are consistent with the requirements of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 1998a).

The sitewide environmental air monitoring program is comprised of the following three distinct components:

- Radiological air particulate monitoring
- Radon monitoring
- Direct radiation monitoring.

The sampling and analytical aspects of each component are unique, therefore this media-specific plan is organized to present a separate discussion of the sampling program for each component. The subsections of this media-specific plan define the following:

- Program organization and associated responsibilities
- Sampling programs (radiological air particulate, radon, and direct radiation)
- Change control
- Health and safety
- Data management
- Project quality assurance.

6.5.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this media-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support and assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standards and assist in evaluating and resolving all quality related concerns.

6.5.2 Sampling Program - Radiological Air Particulates

This sampling program is designed to collect radiological air particulate data which are representative of ambient air conditions at the facility fenceline (Figure 6-1). The data collected under this program will be used to assess the collective effect of concurrent remediation activities on the air pathway, provide continual feedback to the remediation projects on the effectiveness of emission controls, and provide a monitoring basis to support the implementation and track the effectiveness of corrective actions as necessary. As such, field procedures and analytical methods are designed to support the necessary level of data quality.

The monitoring design incorporates a network of 19 high volume continuous air monitoring stations. Filter media are collected on a biweekly basis at AMS-2 through AMS-29 and WPTH-2 will be analyzed at the on-site laboratory for total uranium and isotopic thorium at analytical support level (ASL) B. ASL B provides qualitative, semi-qualitative and quantitative data with some quality assurance/quality control checks. A portion of each biweekly sample is retained for a quarterly composite sample, which is analyzed at ASL E by an off-site laboratory for those radionuclides expected to be the major contributors to dose. For the quarterly composites, ASL E provides quantitative data with fully defined quality assurance/quality control and complete data packages, including raw data and requires lower detection levels than ASL B. Section 6.4.2.1 and Appendix C provide greater detail on the sampling design.

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Sample analysis will be performed at the on-site FEMP laboratory or a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Sections 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

6.5.2.1 Sampling Procedures - Radiological Air Particulates

The air filters from the high volume air monitoring stations are collected and analyzed in accordance with the following procedures which incorporate the requirements of the SCQ listed below and the Environmental Regulatory Guide for Radiological Effluent Monitoring:

Standard Operating Procedure	
ADM-02	Field Project Prerequisites
SMPL-08	High Volume Air Monitoring
EQT-18	Calibration of Graseby GMW High Volume Air Sampler
ADM-09	Air Monitoring Data Review and Analysis
EW-0002	Chain of Custody/Request for Analysis Record for Sample Control

Table 6-5 provides the technical specifications for radiological air particulate monitoring using high volume air monitoring equipment and filter media.

TABLE 6-5

TECHNICAL SPECIFICATIONS FOR RADIOLOGICAL AIR PARTICULATE MONITORING

Monitor Type	Flow Rate	Filter Type	Gauge/Meters	Indicator
High volume continuous	45 cfm	Multi-ply Polyester	Hours Flow Rate Set Point	Low Flow Warning Light

Sample collection is accomplished by using high volume air monitoring stations that continuously collect samples of airborne particulates. Any changes in flow rate are accounted for by the automatic flow controller in the monitor and are documented on a flow chart recorder which continuously records flow data. Air monitoring equipment must meet the following criteria per DOE guidance (DOE 1991) and industry practice:

- Environmental air samplers shall be mounted in locked, all-weather stations with the sampler discharge positioned to prevent the recirculation of air.
- The air sampling system shall have a flow-rate meter, and the total air flow or total running time should be indicated.
- The air sampling rate should not vary by more than 10 percent of the monitor set point of 45 cfm for the collection of a given sample.
- Linear flow rate across air particulate filters should be maintained between 20 and 50 m/min.
- Air sampling systems shall be flow-calibrated, tested, and routinely inspected according to written procedures (DOE 1991). Flow calibration shall be at least as often as recommended by the manufacturer.

The monitors are inspected and calibrated at least once yearly in accordance with recommendations from the manufacturer. All units placed in the field are tracked via a field tracking log which provides information pertaining to when calibrations were last completed and the date of the next scheduled calibration. Fenceline monitors are checked daily to ensure continuous operation.

6.5.2.2 <u>Quality Control Sampling Requirements - Radiological Air Particulates</u>

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as sampling or analytical practice, may be responsible for introducing bias in the project's analytical results. The following quality assurance samples will be collected under this sampling program:

<u>Air Particulate Samples</u>

- One blank sample will be submitted for analysis with each batch of biweekly filters from AMS-2 through AMS-29 for uranium analyses; one blank sample will be submitted for analysis with each batch of biweekly thorium filters from AMS-2 through AMS-29 and WPTH-2 for thorium analyses; and with each set of quarterly composite samples.

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- On a quarterly basis, one spike sample with a known amount of thorium will be submitted for analysis with the biweekly thorium filters. On a biweekly basis, a spike sample with a known amount of uranium will be analyzed with each batch of biweekly filters. The spike sample results are used to monitor the laboratory performance within defined tolerance limits within the established contract and in accordance with the SCQ (typically between 0.75 and 1.25 of the known value).

- The laboratory is also required to perform analyses on method blanks, matrix spikes, and laboratory control samples as required by the SCQ for the corresponding ASL and analytical method. For the quarterly composite samples, analyzed under ASL E, a method blank, duplicate, matrix spike, and laboratory control sample will be analyzed for each batch of samples.

6.5.2.3 Decontamination

The decontamination of the air monitoring equipment is necessary only for those monitors deployed in the former production and waste storage areas. Decontamination for these monitors is conducted under the radiological controls program for releasing equipment from the site. Radiological surveys are performed when equipment is required to be released for transport and/or analysis. These surveys are conducted in accordance with established radiological control procedures.

6.5.2.4 Waste Dispositioning

Contact waste that are generated by the field technicians during field sampling activities are collected, maintained, and dispositioned, as necessary, depending upon the location of waste generation (i.e., former production area or off site). Radiological control procedures govern the disposal of contact wastes generated during air monitoring activities.

6.5.3 Sampling Program - Radon Monitoring

This sampling program is designed to collect measurements of radon concentrations, considering the radon-generating materials contained on site. Sample locations on site, at the boundary fenceline, and off site provide representative measurements for assessing compliance with established limits. In addition, data collected will be used to assess radon concentrations both on site and at the fenceline during remediation activities. As such, field procedures and analytical methods are designed to support the necessary level of data quality.

The monitoring design consists of 34 continuous environmental radon monitors. Data are recorded hourly and compiled into daily averages. The data from the monitors are collected at ASL A. Section 6.4.2.2 provides greater detail on sampling design.

6.5.3.1 Sampling Procedures -Radon Monitoring

The continuous environmental radon monitors are operated in accordance with the following procedures which incorporate the requirements of the SCQ and the Environmental Regulatory Guide for Radiological Effluent Monitoring:

Standard Operating Procedure	
ADM-02	Field Project Prerequisites
SMPL-06	Radon Sampling from Headspace of K-65 Silos
SMPL-09	Continuous Environmental Radon Monitoring
SMPL-25	Pylon CRM-2, Continuous Environmental Radon Monitoring
ADM-14	Evaluating Continuous Radon Monitoring Data
ADM-09	Air Monitoring Data Review and Analysis
RP-0014	Radiation Source Accountability and Control
EM-0030	Silos Area Emergency Procedure

Sitewide CERCLA Quality (SCQ) Assurance Project Plan	
Section 4	Quality Assurance Objectives
Section 5	Field Activities
Section 6	Sampling Requirements
Section 7	Sample Custody
Section 8	Calibration Procedures and Frequency
Appendix I	Field Calibration Requirements
Appendix K	Sampling Methods

Continuous environmental radon monitors are calibrated as a unit at least once per year (as specified per sampling procedures) with National Institute of Standards and Technology traceable sources. Monitors are tracked upon deployment in the field via an equipment tracking log and field logbooks. The instrument background reading is also recorded for use in data evaluation and reporting. Additionally, an equipment maintenance/calibration logbook is used to track and schedule units requiring maintenance and/or calibrations.

Table 6-3 provides a sample and analytical summary for the radon monitoring program. The continuous environmental radon monitors used at the FEMP are alpha scintillation detectors, consisting of a Continuous Passive Radon Detector (CPRD) attached to either a Pylon AB-5 or CRM-2. They are passive devices meaning radon diffuses into the CPRD without the aid of a pump. Alpha particles generated by radioactive decay of the radon and its daughters interact with the inside surface of the detector, producing photons of light. The light photons interact with a photo-multiplier tube which generates electrical pulses. The number of pulses in a given time period is proportional to a radon concentration. The monitors are set to collect measurements of one-hour duration.

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6.5.3.2 Quality Control Sampling Requirements - Radon Monitoring

Quality control practices for the continuous environmental radon monitors will be maintained per established maintenance and calibration schedules outlined in the applicable operating procedures. Quality control data will be recorded on process control charts and only instruments demonstrating acceptable performance will be used in the field to collect data. At a minimum, the continuous environmental radon monitors will be source checked monthly. Acceptable performance is defined as generating source check results that fall within three standard deviations of the mean expected efficiency in accordance with typical industry standard practices. If the source check results for an instrument fall outside the three standard deviation control limits, then that instrument will not be used again until it is examined, repaired, and calibrated, if necessary.

6.5.4 Sampling Program - Direct Radiation (TLDs)

This sampling program is designed to measure the direct radiation at the FEMP from locations which are representative of radiological environmental conditions at select locations on site, at the facility fenceline and in the local community (Figure 6-4). The data collected under this program will be used to assess the collective effect of current remediation activities on the air pathway. As such, field procedures and analytical methods are designed to support the necessary level of data quality.

The monitoring design incorporates a network of 32 TLD locations. Three TLDs are deployed quarterly at each location and submitted to either the on-site dosimetry laboratory or an equivalent vendor laboratory for analysis. External gamma radiation measurements are recorded from each TLD read. All TLDs are analyzed at ASL B.

6.5.4.1 Sampling Procedures - Direct Radiation (TLDs)

The TLDs are collected from environmental monitoring locations in accordance with the following operating procedures which incorporate the requirements of the SCQ and the Environmental Regulatory Guide for Radiological Effluent Monitoring:

Standard Operating Procedures	
ADM-02	Field Project Prerequisites
SMPL-10	Environmental Direct Radiation Monitoring
EW-0002	Chain of Custody/Request for Analysis Record for Sample Control
ADM-09	Air Monitoring Data Review and Analysis

<u>Sitewide CERCLA Quality (SCQ) Assurance Project Plan</u>

Section 4	Quality Assurance Objectives
Section 5	Field Activities
Section 6	Sampling Requirements
Section 7	Sample Custody
Section 8	Calibration Procedures and Frequency
Appendix I	Field Calibration Requirements
Appendix K	Sampling Methods

Table 6-4 provides a sample and analytical summary for the direct radiation monitoring program. Sample collection is accomplished using Panasonic UD-814 dosimeters or equivalent dosimeters. Environmental TLDs must meet the following criteria as per DOE guidance (DOE 1991):

- Environmental TLDs shall be mounted at one meter above ground.
- The frequency of exchange should be based on predicted exposure rates from site operations.
- The exposure rate should be long enough (typically one calendar quarter) to produce a readily detectable dose (DOE 1991).
- Annealing, calibration, readout, storage and exposure periods used should be consistent with the ANSI standard recommendations (ANSI 1975).

All TLDs placed in the field are tracked via a field tracking log which provides information pertaining to when and where dosimeters were deployed as well as scheduled collection date.

6.5.4.2 <u>Quality Control Sampling Requirements - Direct Radiation (TLDs)</u>

Quality control samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as sampling or analytical practice, may be responsible for introducing bias in the project's analytical results. Quarterly data from the three TLDs at each location must agree within 15 percent or will be considered suspect and invalid data. A TLD that repeatedly differs by more than 15 percent from the other two co-located TLDs will be removed from service. The following quality assurance practices will be conducted under this sampling program:

- TLD reader is calibrated semiannually and quality control checks are performed prior to reading each batch of TLDs.
- Quarterly, spiked dosimeters with a known amount of gamma radiation are submitted for analysis (must agree within 10 percent of known dose).

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- The FEMP will participate in interlaboratory comparisons conducted by DOE. The comparison studies require the FEMP to submit a set of TLDs which are then exposed (along with TLDs from other study participants) to a known amount of environmental radiation. The TLDs are then returned to the FEMP for processing. The results from all participants are then compared to known value of radiation and the 30 percent performance specification from ANSI-N545.

6.5.4.3 Decontamination

Decontamination of environmental TLD is not necessary because the units are self contained, unless collected from known areas of high contamination. Only the units which hold the TLD and have been stationed in the former production area are required to undergo cleaning and decontamination if deemed necessary upon a radiological survey. Radiological surveys are performed when equipment and/or samples are required to be released from the former production area for transport and/or analysis. These surveys are conducted in accordance with established radiological control procedures.

6.5.4.4 Waste Dispositioning

Contact wastes generated by the field technicians during sample collection activities are collected, maintained and dispositioned as necessary, depending upon the location of waste generation (i.e., former production area or off site). Contact waste generated outside of radiological control areas will be placed in a clean trash dumpster. Contact waste generated within radiological control areas will be disposed of in a designated radiological contact waste container.

6.5.5 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have approval by the designee and quality assurance representative prior to implementation. In accordance with Section 15.3 of the SCQ, the completed Variance/Field Change Notice must be approved by quality assurance within one week of verbal approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members, included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the media-specific plan.

6.5.6 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this media-specific plan. Safety meetings will be conducted prior to beginning field work to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed applicable training.

For areas which are subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a radiation work permit.

6.5.7 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2001 and 2002 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying media-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with media-specific plan-specified ASLs. Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. For 2001 and 2002 field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. For some air programs, a more conservative ASL is required for laboratory data to meet regulatory commitments, to meet required detection limits, or to ensure data quality objectives are met. The specific air monitoring ASL requirements are detailed in the above sampling programs subsections and in Appendix C.

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At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

6.5.8 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ and FEMP Quality Assurance Program (RM-0012) requirements.

Recommended quarterly quality assurance assessments or surveillances shall be performed on tasks specified in the media-specific plan. These assessments may be in the form of independent assessments or self-assessments, with at least one independent assessment conducted annually. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

6.6 IEMP AIR MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP air monitoring program in 2001 and 2002. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated air monitoring data, including specific information to be reported in IEMP quarterly summaries and in annual integrated site environmental reports, is also provided.

6.6.1 Data Evaluation

Data resulting from the IEMP air monitoring program will be evaluated to meet the program expectations identified in Section 6.4.1. Based on these expectations, the following questions will be answered for all air monitoring programs:

- Are the program and reporting requirements of DOE Order 5400.1 being met?

DOE Order 5400.1 requires that DOE-FEMP implement and report on an environmental protection program for the FEMP. The air monitoring program is one component of the sitewide IEMP monitoring program. This IEMP and annual integrated site environmental reports fulfill the requirements of this DOE Order.

- Are community concerns being met through the air monitoring IEMP program?

The IEMP fulfills the needs of the Fernald community by presenting air monitoring results in IEMP annual integrated site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center, which is located a half mile south of the FEMP on Oakridge Drive in the Delta Building.

Specific air program (i.e., radiological air particulate, radon, and direct radiation) evaluation process questions are identified in the following subsection.

6.6.1.1 Radiological Air Particulate Data Evaluation

Based on the expectations in Section 6.4.1, the following questions will be answered for the radiological air particulate program:

- Are the emission control measures executed by the remediation projects effective in maintaining exposures to the public below the annual 10 mrem NESHAP Subpart H standard?

Biweekly uranium and quarterly composite data from air monitoring locations AMS-2 through AMS-29 and biweekly thorium data from AMS-2 through AMS-29 and WPTH-2 will be compared to historical air measurements and trend analysis will be performed to assess the collective effectiveness of emission control measures. Basic statistics, such as minimum, maximum, and mean, will be generated per sample location on a routine basis (as the data are received from the laboratory). The data generated from individual sampling events will be trended by sample location over time via graphical and statistical (when sufficient data have been generated) methods. Monitoring results will be evaluated in light of project operations active during the period and the associated meteorological conditions (i.e., wind roses, precipitation levels, etc.) in order to correlate monitoring results with (upwind) project activities. In addition, any project-specific monitoring and operations data will be used to support this data evaluation. If monitoring data indicate an increasing trend which, if sustained, could result in an exceedance of the 10 mrem NESHAP standard, then immediate notification will be targeted to the project(s) suspected of contributing to the increased emissions (based on the monitoring location[s] exhibiting the elevated results, the prevailing meteorological conditions and project activities conducted during the sampling period) and action will be taken at the project level to further control fugitive emissions. If increasing trends are identified, but indicate the NESHAP standard is not in jeopardy of being exceeded (based on current trend analysis and the anticipated schedule of project activities), then projects will review remediation activities and the application of the sitewide BAT determination for fugitive dust control to ensure all project activities are compliant. Additional fugitive dust controls may be implemented as provided for in the BAT determination based on the project review. Figure 6-5 provides a schematic of the specific decision-making process for the radiological air particulate monitoring program. Additionally, this information will support the collective decision-making process as outlined in Section 1.0.

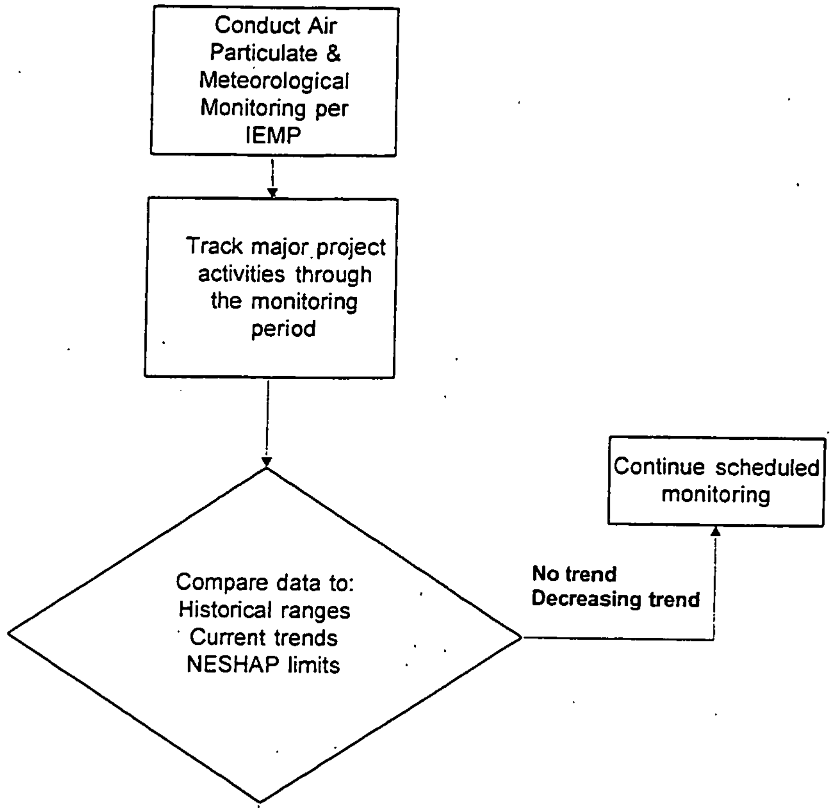
- Do the results of quarterly composite radionuclide concentrations indicate that the dose limit of NESHAP, Subpart H may be exceeded?

Data evaluation will consist of direct comparison of the quarterly composite data to the NESHAP Subpart H Appendix E, Table 2 values. If, after considering the planned remediation activities for the rest of the year, the sum of the fractions (measured concentrations divided by the corresponding NESHAP limit) indicates that exceeding the 10 mrem/year limit is likely, then increased emission control measures (modification and/or curtailment of remediation activities) will be initiated.

- Are modifications or adjustments in program focus necessary?

The quarterly composite results will be compared to the NESHAP Appendix E, Table 2 values. If the comparison indicates a contaminant other than uranium and thorium is contributing the largest percentage of dose, then modifications to the IEMP air monitoring and analytical schedule will be proposed in order to better monitor the major contributors to inhalation dose. The biweekly total particulate measurements will be used to evaluate the filter loading and may result in changes to the sampling frequency if excessive loading is observed based on total particulate concentrations in conjunction with diminishing flow-rates through the filter.

FIGURE 6-5
IEMP AIR PARTICULATE DATA EVALUATION AND ASSOCIATED ACTIONS



If concentration is trending above historical ranges,[a] but not expected to exceed NESHAP limit

IEMP Actions	Potential Project Actions
Review pertinent project-specific data Identify probable source(s) and alert associated project(s) Continue scheduled monitoring Report information to EPA/ OEPA in next quarterly summary and in the annual report	Review performance/ inspection data for engineered controls Determine if emission controls meet design specifications Estimate duration of source activities Repair/enhance emission controls, if necessary

[a] These determinations will be based on the significance of the trend and the projected scope and duration of the source activity.

If concentration is trending above historical ranges,[a] and potential exceedance of NESHAP limit exists

IEMP Action	Potential Project Action
Review pertinent project-specific data Identify probable source(s) and alert associated project(s) Evaluate need for increasing sampling frequency and/or analytical regime to track performance of corrective actions Report information to EPA/ OEPA in next quarterly summary and in the annual report	Review performance/ inspection data for engineered controls Determine if emission controls meet design specifications Estimate duration of source activities Repair/enhance existing emission controls Implement additional emission controls as necessary Modify project schedule as necessary to limit emission rate

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6.6.1.2 Radon Data Evaluation

Data resulting from the radon monitoring program will be evaluated with respect to the program expectations identified in Section 6.4.1 and radon monitoring design summary in Section 6.4.2.2. Based on these expectations, the following questions will be answered through the radon data evaluation processes indicated by the text following each of the questions:

- Are radon concentrations below the limits set in DOE Order 5400.5?

Data from the alpha scintillation continuous radon monitoring locations will be compared to the annual limits (3 pCi/L fenceline and 30 pCi/L sitewide) and short-term (100 pCi/L) limits of DOE Order 5400.5. Basic statistics, such as minimum, maximum, and mean, will be generated on a monthly basis for the alpha scintillation monitors. The data generated from individual sampling events will be trended by sample location over time via graphical, tabular, and statistical (when sufficient data have been generated) methods. If historic data are available for or near a particular IEMP sample location, then the IEMP-generated trends will be evaluated with respect to the historic trends in order to assess whether current conditions are similar to the past, increasing, or decreasing. Meteorological data (i.e., wind roses, temperature inversions, etc.) from the sampling period will be used to determine which radon source is likely to have contributed to the observed data. In addition, any project-specific monitoring and operational data from radon source areas will be used to support this data evaluation. If trends indicate that radon concentrations will exceed DOE Order 5400.5, then actions shown in Figure 6-6 will be implemented. Integration of radon air monitoring information generated by project-specific monitoring (i.e., the Operable Unit 4 remediation facilities) will occur as necessary in interpreting the sitewide radon data via the IEMP data evaluation process. The findings of data evaluations will be shared with project personnel. Those personnel responsible for the K-65 Silos, waste pit excavation, and other radon emission sources will be informed of the findings as indicated on Figure 6-6.

- Do current radon monitoring and reporting activities comply with FFA/Federal Facilities Compliance Agreement requirements?

Removal Action No. 4 requires that monitoring of the radon concentration in the head space of each K-65 Silo be performed on a continuous basis until the radium-bearing materials inside are removed. In addition to reporting this data, data from all continuous monitors are reported.

- Are modifications or adjustments in the radon program focus necessary?

FIGURE 6-6
IEMP RADON DATA EVALUATION AND ASSOCIATED ACTIONS

Conduct radon & meteorological monitoring per IEMP

↓

Track project activities associated with major radon sources through the monitoring period

↓

Compare data to:
- Historical ranges
- Current trends
- DOE 5400.5 limits

No trend or decreasing trend → Continue scheduled monitoring

If concentration is trending above historical ranges,[a] but not expected to exceed DOE Order 5400.5 limits

IEMP Actions	Potential Project Actions
Review pertinent project-specific data	Review performance/ inspection data for engineered controls
Identify probable source(s) and alert associated project(s)	Determine if emission controls meet design specifications
Continue scheduled monitoring	Estimate duration of source activities
Report information to EPA/ OEPA in next IEMP quarterly summary and in the annual report	Repair/enhance emission controls, if necessary

If concentration is trending above historical ranges[a] and potential exceedance of DOE Order 5400.5 limits exist

IEMP Actions	Potential Project Actions
Review pertinent project-specific data	Review performance/inspection data for engineered controls
Identify probable source(s) and alert associated project(s)	Determine if emission controls meet design specifications
Evaluate need for increasing data review frequency to track performance of corrective actions	Estimate duration of source activities
Report information to EPA/ OEPA in next IEMP quarterly sumary and in the annual report	Repair/enhance existing emission controls
	Implement additional emission controls as necessary
	Modify project schedule as necessary to limit emission rate

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[a]For those constituents/locations with limited historical data, IEMP data will be compared to background concentrations.

I:\IEMP-NEW\2000\10-00\FIGURES\2000FIG6-6.VSD

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Changes to the monitoring program will be evaluated based on the expected changing configuration of the primary radon source materials at the site (most importantly the K-65 Silo material), prior to remediation of these materials. Revisions to the program will be proposed through the annual review and biennial revision process as outlined in Section 1.0.

6.6.1.3 Direct Radiation Monitoring Data Evaluation

Data resulting from the direct radiation monitoring program will be evaluated with respect to the program expectations identified in Section 6.4.1 and direct radiation monitoring design summary in Section 6.4.2.3. Based on these expectations, the following questions will be answered through the direct radiation data evaluation processes indicated by the text following each of the questions:

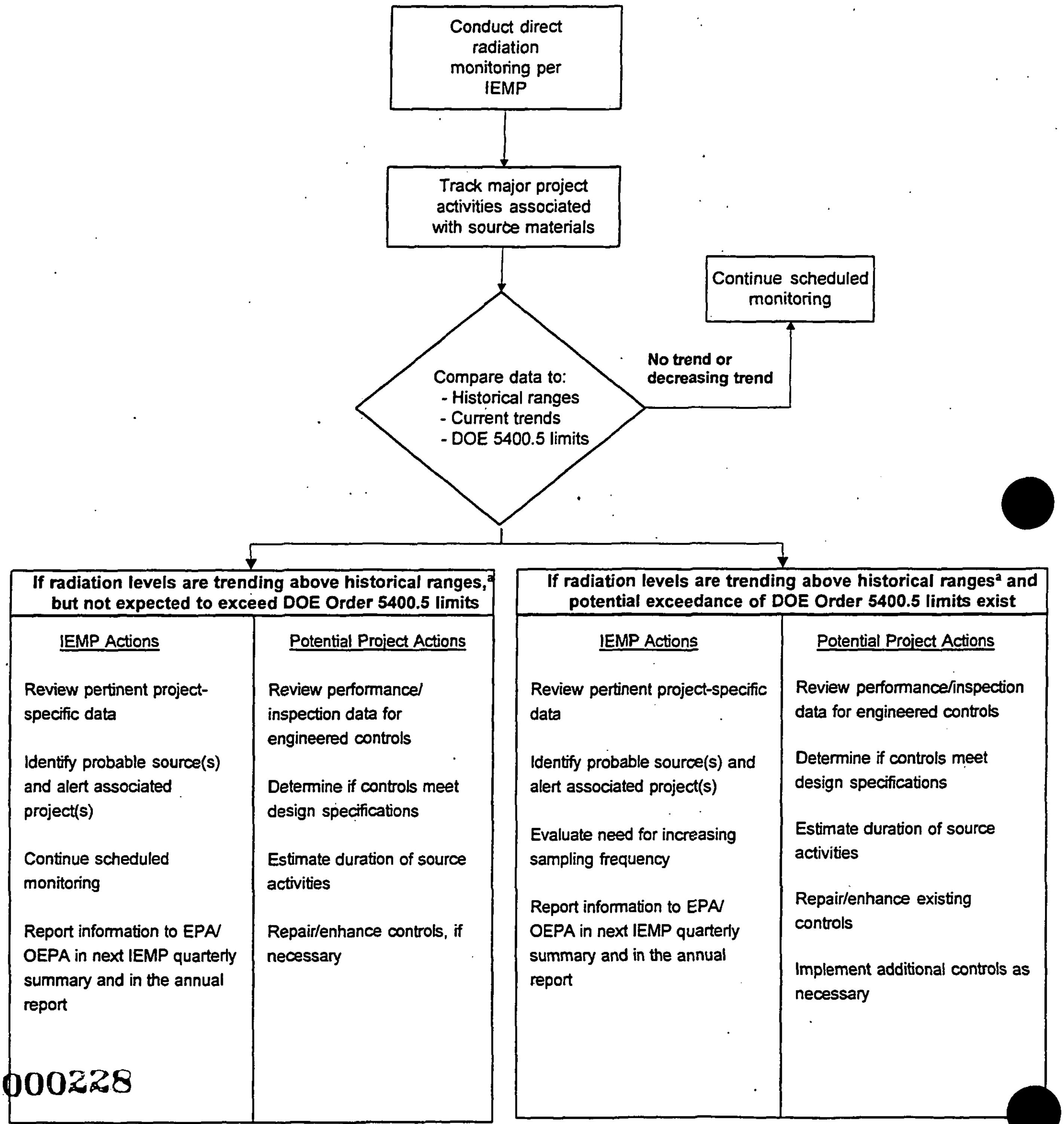
- Do direct radiation levels indicate a significant increase which could contribute to an exceedance of the 100 mrem/year all-pathway dose limit from DOE Order 5400.5?

The data generated from individual TLD locations will be trended over time via graphical and statistical (when sufficient data have been generated) methods. Basic statistics, such as minimum and maximum, will be generated on a quarterly basis. Historic TLD monitoring data will be used to assess whether current trends are similar to the past, increasing, or decreasing. In addition, any project-specific and operational data from areas with large sources of direct radiation will be used to support the evaluation and interpretation of TLD results. Data from the TLD locations will be used to assess the direct radiation component of the all-pathway dose (Appendix C). If trends indicate a significant increase above historical ranges which could contribute to an exceedance of the 100 mrem/year all-pathway dose limit, then actions shown in Figure 6-7 will be implemented. Direct radiation monitoring information generated by project-specific occupational monitoring will be used as necessary in interpreting the sitewide direct radiation data via the IEMP data evaluation process. The findings of the ongoing data evaluations will be shared with project personnel. Those personnel responsible for the K-65 Silos and other direct radiation sources will be informed of the findings as indicated on Figure 6-7.

- Are modifications or adjustments in program focus necessary?

Changes to the direct radiation monitoring program will be evaluated based on the changing configuration of source materials (primarily K-65 Silo waste materials) at the site, prior to remediation of these materials. Revisions to the program will be proposed through the annual review and biennial revision process as outlined in Section 1.0.

FIGURE 6-7
IEMP TLD DATA EVALUATION AND ASSOCIATED ACTIONS



[a]These determinations will be based on the significance of the trend and the projected scope and duration of the source activity.

I:\IEMP-NEW\2000\10-00\FIGURES\2000FIG6-7.VSD

6.6.2 Reporting

The IEMP air monitoring program will meet the reporting requirements for the NESHAP Subpart H and the FFA compliance, as follows:

- The NESHAP Subpart H report has been incorporated into IEMP annual integrated site environmental reports.
- The quarterly FFA reporting has been incorporated into the IEMP reporting structures.

IEMP air program data will be reported in the form of a Data Extranet Site (the IEMP Data Information Site), quarterly summaries, and annual integrated site environmental reports. Additional information on IEMP data reporting is provided in Section 8.3.3.

Data pertaining to the air monitoring program will be provided on an Extranet Site. The data will be in the format of searchable data sets and/or downloadable data files. This site will be updated every two to four weeks, as data become available.

The IEMP quarterly summary will supplement the Extranet Site by providing a brief summary of the data added to the site that quarter and identifying notable results and/or events related to that data. The IEMP quarterly summaries will be submitted at approximately 30 days from the end of the quarter.

The IEMP annual integrated site environmental reports will be issued each June. The comprehensive report will discuss a year of IEMP data previously reported on the Extranet Site and in the quarterly summaries. The air monitoring portion of the IEMP annual integrated site environmental report will consist of the following:

- An annual summary of data from the IEMP air monitoring program
- Constituent concentrations for each sample location
- Statistical analysis summary for each constituent, as warranted by data evaluation
- Status of regulatory compliance with NESHAP Subpart H
- Summarize FFA radon information
- Information that indicates an impact at or beyond the FEMP fenceline at a location not covered by the IEMP monitoring network

- Information that indicates the exceedance of an ARAR at an on-site location (for example, the radon limit of 100 pCi/L)

- Information that is relevant to explaining significant changes in the data from the IEMP air monitoring network.

Because the IEMP is a living document, a structured schedule of annual reviews and two-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any air monitoring program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

Section 7.0

7.0 BIOTA MONITORING PROGRAM

Section 7.0 provides the monitoring strategy for assessing the sitewide impact of the Fernald Environmental Management Project (FEMP's) remediation activities on biota (primarily produce) in the vicinity of the FEMP. This section also identifies the integrated objectives for biota monitoring; analyzes program drivers; describes the programmatic boundary for the Integrated Environmental Monitoring Plan (IEMP) biota monitoring program; presents the program expectations and design considerations, a biota sampling and analysis media-specific plan, and a discussion of data evaluation. The IEMP program for monitoring biota during remediation is much more limited than the other monitoring programs presented. The distinctions are discussed in detail in this section.

7.1 INTEGRATION OBJECTIVES FOR THE BIOTA MONITORING PROGRAM

At three-year intervals, which began in 1997, the IEMP will be used to determine concentrations of contaminants in samples of area biota for comparison to current and historic concentrations; this analysis will assess impacts to biota that may be related to site remediation. This assessment will be integrated with the assessments of the other media sampled under the IEMP in annual integrated site environmental reports, according to the reporting schedule established in Section 7.6 and summarized for all media in Section 8.0. Ultimately, the IEMP will provide the approach for determining when biota monitoring related to remediation can be discontinued.

7.2 ANALYSIS OF REGULATORY DRIVERS, DOE ORDERS, AND OTHER FEMP-SPECIFIC AGREEMENTS

7.2.1 Approach

This section presents an evaluation of the regulatory drivers governing biota monitoring during site remediation. The intent of this section is to identify the pertinent regulatory requirements, including applicable or relevant and appropriate requirements and to be considered-based requirements, for the scope and design of the biota monitoring program.

The analysis of the regulatory drivers and policies was conducted by examining each of the FEMP's approved Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) operable unit's record of decision to identify any biota-specific monitoring requirements. An evaluation of the FEMP's regulatory drivers for biota monitoring was conducted to confirm that the existing environmental monitoring program scope, which historically has satisfied public concerns and

U.S. Department of Energy (DOE) Orders 5400.1 and 5400.5 requirements, also meets any additional requirements for biota monitoring that may have been activated by each of the FEMP's CERCLA operable unit's record of decision.

7.2.2 Results

The results of the evaluation indicate the drivers of the IEMP biota monitoring program are the following DOE Orders (no CERCLA-driven requirements were identified):

- DOE Order 5400.1, General Environmental Protection Program, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine effluent monitoring and environmental surveillance activities of the facility. The Fernald Site Environmental Monitoring Plan (FERMCO 1995) provided the initial basis for the development of the IEMP strategy that is responsive to the changing site mission and associated remediation needs while still DOE-Order compliant.

- DOE Order 5400.5, Radiation Protection of the Public and the Environment, which establishes radiological dose limits and guidelines for the protection of the public and environment. Under this requirement, the exposure to members of the public associated with activities at DOE facilities from all pathways must not exceed, in one year, an effective dose equivalent of 100 millirem (mrem). Compliance with this limit is determined by calculating the radiological dose using monitoring data. In accordance with the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE 1991) media-specific surveillance monitoring is not required if doses from secondary pathways (such as produce, fish, meat, and milk) are less than one mrem per year. Based on repeated sampling of fish in the Great Miami River, and produce, grass, meat, and milk obtained from the area surrounding the FEMP, the doses from these secondary pathways are consistently less than one mrem per year. Therefore, surveillance monitoring of secondary pathways is not specifically required at the FEMP.

Table 7-1 outlines the above regulatory drivers and the associated monitoring for biota. As discussed in Section 7.4.2, the monitoring of secondary and tertiary exposure pathways, with the exception of produce, has been discontinued. Produce sampling will be continued to accommodate specific public interest in this medium. Sections 7.6 and 8.0 provide the FEMP's current and long-range plan for complying with the biota sampling requirements involved by the IEMP regulatory drivers.

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TABLE 7-1

**FEMP BIOTA MONITORING PROGRAM
REGULATORY DRIVERS AND RESPONSIBILITIES**

	DRIVER	ACTION
IEMP	DOE Order 5400.1	The IEMP describes surveillance biota monitoring as required by DOE Order 5400.1.
IEMP	DOE Order 5400.5	The IEMP describes off-site biota monitoring for radionuclides to assess compliance with dose limits to the public.

7.3 PROGRAMMATIC BOUNDARY FOR THE BIOTA MONITORING PROGRAM

This section identifies the programmatic boundary that has been established between the IEMP and activities conducted by other projects. The intent of establishing a boundary definition is to clearly delineate the scope and geographic extent of the IEMP's monitoring responsibility. In 2003 and every third year thereafter, the IEMP biota monitoring program will include only produce sampling. A second boundary important to discussion of the biota monitoring program is the physical boundary. The FEMP property boundary represents the starting point from which biota samples will be collected.

7.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

7.4.1 Biota Monitoring Program Expectations

The IEMP biota sampling program is essentially a continuation of the former Environmental Monitoring Plan biota surveillance monitoring program. The expectations for the program are to collect data sufficient to:

- Determine if substantive changes occur in contaminant concentrations observed in area biota
- Determine if the program should continue as is, be refined in scope, or be discontinued in the future, based on accumulated results
- Continue to address the concerns of the community associated with future remediation activities at the FEMP.

7.4.2 Biota Monitoring Program Design Considerations

The IEMP will include only produce sampling to accommodate public concerns. As discussed in Section 7.2.2, there are no specific regulatory drivers requiring the continuation of the fish, meat, milk, grass, and soil sampling. Regardless of the lack of regulatory drivers requiring monitoring of this media, there is sufficient justification to cease monitoring, as discussed in the IEMP, Revision 1 (DOE 1999).

The IEMP is focusing on those primary pathways (air, surface water, and groundwater) to various receptors to provide indications about the impacts of site remediation on the surrounding environment. If, in the future, monitoring of the primary pathways suggests a potential for increased levels of exposure through the secondary or tertiary pathways, then further evaluation may be warranted. The evaluation to determine additional monitoring needs in secondary and tertiary pathways will be completed annually as part of IEMP review and reporting, and is consistent with the "living document" role of the IEMP.

The implementing guidance for DOE Orders 5400.1 and 5400.5 also specifies that surveillance monitoring of various media may be necessary for other reasons, including addressing public concerns. During meetings, members of the public have expressed an interest in the continuation of produce sampling near the FEMP as an assurance measure; therefore, produce sampling will continue at three-year intervals during remediation.

The design considerations to address the expectations listed in Section 7.4.1 are as follows:

- Sample locations should, in general, be consistent with current environmental monitoring locations so that comparable areas are evaluated.
- Sampling frequency, constituents analyzed, and analytical support level (ASL) should be consistent with the historical data so that appropriate comparisons can be made.
- Sampling should provide data to continue to confirm that dose received from eating produce grown near the site is below the threshold established by DOE Order 5400.5.

The biota sample program was initiated in the late 1980s in response to FEMP stakeholder concerns about the impacts of historical and then current emissions from the site. Through the 1990s, the program has been gradually scaled back as the data repeatedly confirmed that site emissions had no measurable impact on biota.

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7.4.3 Biota Monitoring Program Design

Under the biota monitoring program, the produce sample locations are selected using the following guides:

- Locations that are next to or near the site are preferred.
- Locations that are downwind of the site (based on the predominant wind direction) are preferred.
- Locations that have commonly grown vegetables such as beans, corn, or tomatoes are preferred.
- Background locations that are at least three miles from the site and in the least predominant wind direction are preferred.

Sample locations vary from year to year, depending on the willingness of the property owner to participate in the program and on local weather fluctuations that can influence the success and desirability of domestic gardening.

Typically, 20 to 40 samples from about 20 locations are collected and analyzed for total uranium. Analyses for other constituents (e.g., thorium-230 and radium-226) may be performed to address concerns about the impact from other radionuclides in the airborne emissions from the FEMP.

7.5 MEDIA-SPECIFIC PLAN FOR PRODUCE SAMPLING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the sitewide environmental biota sampling program. The activities described in this plan were designed to provide produce sampling data of sufficient quality to meet the program expectations as stated in Section 7.4.1. The program expectations in conjunction with the design considerations presented in Section 7.4.2 were used as the framework for developing the monitoring approach presented in this media-specific plan. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 1998a).

Subsequent sections of this media-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety

7.5.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this project-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support, and to assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standards and to assist in evaluating and resolving all quality related concerns.

7.5.2 Sampling Program

Figure 7-1 depicts the locations for produce sample collection. The locations shown in Figure 7-1 are approximate and change based on the availability of samples from farms and gardens and the willingness of local residents to participate in the program. An estimated minimum of 15 produce samples is required to meet the program expectations. Produce samples will be collected every three years and

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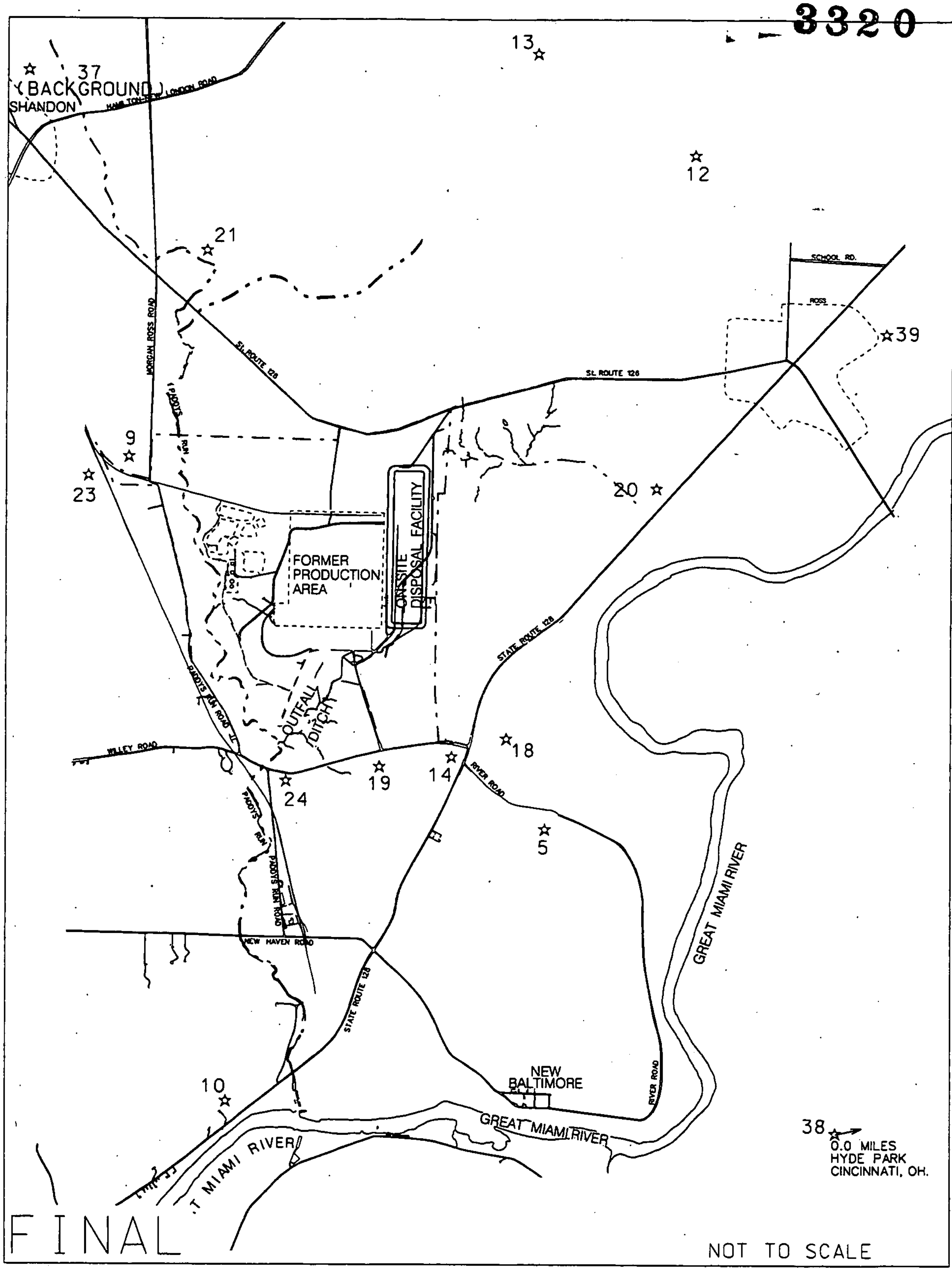

LEGEND:

☆ PRODUCE MONITORING LOCATION

—·—·— FEMP BOUNDARY

DISTANCE FROM FORMER PRODUCTION AREA TO MONITORING LOCATIONS OFF MAP

NOTE: THESE ARE PROPOSED LOCATIONS (BASED ON AVAILABILITY)

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FIGURE 7-1. PRODUCE MONITORING LOCATIONS

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analyzed according to the analytical requirements shown in Table 7-2. The most recent round of produce sampling was conducted in August and September of 2000 and the next round will be performed in 2003.

TABLE 7-2

ANNUAL PRODUCE SAMPLE ANALYTICAL REQUIREMENTS

Location	Sample Size (grams)	Type	Number of Samples[a]	Constituent[b]	ASL[c]	Container	Holding Time	Preservative
See Figure 7-1	$\geq$500	Grab	Min. of 15	Uranium, Total	B	Plastic bag	6 months	Freezing

[a]The number of individual produce samples will vary depending upon private participation and availability. Approximately 20 produce or crop locations exist for which samples may be collected.
[b]Analysis for other constituents (e.g., thorium-230) may be performed to address concerns about the impact from other radionuclides in airborne emissions from the FEMP.
[c]A more conservative ASL may be required for laboratory data in order to meet required detection limits or to ensure data quality objectives.

Sample analysis will be performed at a contract laboratory dependent on specific analyses required, laboratory capacity, turn-around time, and performance of the laboratory. The laboratories utilized for analytical testing must be approved by the FEMP in accordance with the criteria specified in Sections 3.1.5, 12.4, and Appendix E of the SCQ. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits and an internal quality assurance program. A list of FEMP-approved laboratories and current status of each is maintained by the FEMP quality assurance organization.

7.5.2.1 Sampling Procedures

Produce sampling is conducted in accordance with the task-specific standard operating procedures referenced below to assess the impact of FEMP remediation activities on produce grown near the FEMP. The procedures incorporate the requirements of the SCQ as follows:

Standard Operating Procedure	
ADM-02	Field Project Prerequisites
SMPL-14	Produce Sampling
EW-0002	Chain of Custody/Request for Analysis Record for Sample Control
PM-4000	Miscellaneous Shipping Order Preparation

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Sitewide CERCLA Quality (SCQ) Assurance Project Plan

Section 4	Quality Assurance Objectives
Section 5	Field Activities
Section 6	Sampling Requirements
Section 7	Sample Custody
Section 8	Calibration Procedures and Frequency
Appendix J	Field Activity Methods
Appendix K	Sampling Methods

Sampling conditions to be considered during sampling are as follows:

- Produce should be in good (edible) condition.
- Commonly grown fruits and vegetables (e.g., tomatoes, beans, and corn) should be selected for sampling.
- When possible, collect a portion of the total sample from several plants within the garden. The produce should not be rinsed.
- Collect a minimum of 500 grams of produce per sample.

The sample location shall be described and/or sketched in the field log for the sampling event. Calibration of the field balance before field activities is required by the SCQ.

7.5.2.2 Quality Control Sampling Requirements

Quality control samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as decontamination, sampling or analytical technique, may be responsible for introducing bias in the analytical results. The radiological data will be sampled and analyzed at ASL B. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks. Field duplicates will be collected for every 20 samples in accordance with the standard operating procedure.

7.5.2.3 Decontamination

As stated in Section K.11 of the SCQ, sample collection equipment shall be decontaminated between sample locations using a Level II decontamination process to prevent the introduction of contaminants or cross-contamination into the sampling process.

7.5.2.4 Waste Dispositioning

Contact wastes that are generated by the field technicians during field sampling activities are collected, maintained, and dispositioned depending upon the location of waste generation (i.e., former production area or off site). Contact waste generated outside of radiological control areas will be placed in a clean trash dumpster. Contact waste generated within radiological control areas will be disposed of in a designated radiological contact waste container.

7.5.3 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have approval by the designee and quality assurance representative prior to implementation. In accordance with Section 15.3 of the SCQ, the completed Variance/Field Change Notice must be approved by quality assurance within one week of verbal approval. The Variance/Field Change Notice form shall be issued as controlled distribution to team members, included in the field data package and become part of the project record. During biennial revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the media-specific plan.

7.5.4 Health and Safety Considerations

The FEMP Health and Safety organization is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed during team briefings.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this media-specific plan. Safety meetings will be conducted prior to beginning field work to address specific health and safety issues. All Fluor Fernald employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed applicable training.

7.5.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, conform with appropriate sections and appendices of the SCQ, and comply with specific FEMP procedures, such as the Data Validation Procedure, EW-0010.

Data documentation and validation requirements for data collected in 2003 for the IEMP generally fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying media-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with media-specific plan-specified ASLs. Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with SCQ and FEMP procedures.

There are five analytical levels (ASL A through ASL E) defined for the FEMP in Section 2 of the SCQ. For produce collected in 2003, field data documentation will be at ASL A and laboratory data documentation, in general, will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives are met. In general, ASL B is appropriate for laboratory generated data collected in 2003, because the data are being used for surveillance during site restoration.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project file in accordance with FEMP record keeping procedures and DOE Orders.

7.5.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, SCQ and FEMP Quality Assurance Program (RM-0012) requirements.

A quality assurance assessment or surveillance shall be performed on tasks specified in the media-specific plan during each produce sampling event (once every three years). This assessment may be in the form of an independent assessment or a self-assessment. Independent assessments are the responsibility of designated project quality assurance personnel. Self-assessments are performed by project personnel to self-evaluate the overall quality of work performance. The project team leader and quality assurance will coordinate assessment activities and comply with Section 12 of the SCQ. The project personnel or quality assurance representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

Only laboratories on the approved laboratory list will be used for FEMP sample analyses in accordance with Section 12 and Appendix E of the SCQ.

7.6 IEMP BIOTA MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated by the IEMP produce sampling program in 2003. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for produce data, including specific information to be reported in IEMP quarterly summaries and in annual integrated site environmental reports, is also provided.

7.6.1 Data Evaluation

Data resulting from the IEMP produce sampling will be evaluated to meet the program expectations identified in Section 7.4.1. Based on these expectations, the following questions will be answered through the produce data evaluation process, as indicated:

- Have substantive changes occurred in contaminant concentrations observed in area produce?

Data evaluation will consist of basic statistical analysis (i.e., mean, minimum, and maximum) and comparison to historical data and background to determine if substantive changes occur in contaminant concentrations in area produce. Additionally, should air emissions exceed historical ranges for a sustained period, modification of the IEMP biota monitoring program will be considered. Data evaluation will also address whether produce sampling should continue on a three-year cycle.

- Are the program and reporting requirements of DOE Order 5400.1 being met?

DOE Order 5400.1 requires that DOE-FEMP implement and report on an environmental protection program for the FEMP. The biota monitoring program, specifically produce sampling, is one component of the sitewide IEMP monitoring program. This IEMP and annual integrated site environmental reports fulfill the requirements of this DOE Order.

- Are community concerns being met through the produce sampling?

- The IEMP fulfills the needs of the Fernald community by presenting produce results once every three years in annual integrated site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center, which is located a half mile south of the FEMP on Oakridge Drive in the Delta Building.

7.6.2 Reporting

The IEMP biota program data will be reported in the form of a Data Extranet Site (the IEMP Data Information Site), quarterly summaries, and annual integrated site environmental reports. Additional information on IEMP data reporting is provided in Section 8.3.3.

Data pertaining to the IEMP biota program will be provided on an Extranet Site. The data will be in the format of searchable data sets and/or downloadable data files. This site will be updated every two to four weeks, as data become available.

The IEMP quarterly summary will supplement the Extranet Site by providing a brief summary of the data added to the site that quarter and identifying notable results and/or events related to that data. The IEMP quarterly summaries will be submitted at approximately 30 days from the end of the quarter.

The IEMP annual integrated site environmental reports will be issued each June. The comprehensive report will discuss a year of IEMP data previously reported on the Extranet Site and in the quarterly summaries. The IEMP annual integrated site environmental reports will include the following:

- An annual summary of data from the IEMP produce sampling
- Constituent concentrations for each produce sample
- Statistical analysis summary for constituents, as warranted by initial data evaluation.

Because the IEMP is a living document, a structured schedule of annual reviews and two-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any biota monitoring program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to the U.S. Environmental Protection Agency and Ohio Environmental Protection Agency.

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Section 8.0

8.0 PROGRAM SUMMARY AND REPORTING

8.1 INTRODUCTION

This section summarizes the Integrated Environmental Monitoring Plan (IEMP), highlighting two key program areas: program design and integrated reporting strategy. The program design section explains the technical approach taken in developing the IEMP and outlines the strategy for reviewing and revising the IEMP. The reporting section integrates the reporting discussion in Sections 3.0 through 7.0 and provides an overview of the entire IEMP reporting strategy.

8.2 PROGRAM DESIGN

As discussed throughout this plan, the IEMP combines remediation-based environmental monitoring requirements that have been activated by the applicable or relevant and appropriate requirements (ARARs) and to be considered-based requirements (contained in the Fernald Environmental Management Project's [FEMP's] Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] remedy decision documents) as well as other ongoing monitoring programs required by other regulatory requirements. In combining these elements, the IEMP establishes a sitewide environmental monitoring program that is aligned with the broad range of remediation activities being implemented at the FEMP, and continues to meet the effluent and surveillance monitoring requirements of U.S. Department of Energy (DOE) Orders 5400.1 and 5400.5. Furthermore, by acknowledging the global remediation strategy and focusing the monitoring program design on a discrete two-year window of remediation activities, the IEMP will forecast and be responsive to emerging monitoring needs.

IEMP media-specific monitoring programs were developed through a systematic evaluation of existing monitoring scope, technical considerations, pertinent regulatory drivers, and critical FEMP stakeholder concerns. Programmatic boundaries between the IEMP and project-specific monitoring were identified during this evaluation to clearly delineate the scope and geographic extent of the IEMP monitoring and reporting responsibilities.

8.2.1 Programmatic Boundaries

Programmatic boundaries between the sitewide environmental monitoring program and the projects have been identified as part of the IEMP. As discussed in Section 1.0, these boundaries are defined for monitoring and reporting activities. The IEMP presents a sitewide monitoring approach focused on assessing the collective impacts of FEMP remediation activities. As such, a fundamental programmatic boundary exists between the global monitoring approach of the IEMP and the primarily emissions-control monitoring focus of the individual remediation projects.

The IEMP is designed to provide accurate, accessible, and manageable environmental monitoring information during remediation to support the following:

- Continued compliance with the monitoring and reporting requirements contained in DOE Orders 5400.1 and 5400.5
- Monitoring the performance of the Great Miami Aquifer groundwater remedy, including determination of when restoration activities are complete
- Providing a consolidated reporting mechanism for environmental data.

The following list summarizes the activities that fall outside the scope of the IEMP:

- Project-specific emission-control monitoring for both point and area sources
- The soil remediation pre-certification and certification sampling program which will be conducted as part of the work scope of the Soil and Disposal Facility Project
- The ambient air sampling and direct radiation measurements conducted for worker health and safety purposes as part of the FEMP's occupational monitoring program
- The FEMP's spill and chemical release reporting required under Superfund Amendments and Reauthorization Act Title III.

8.2.2 IEMP Monitoring Summary for 2001 and 2002

The 2001 and 2002 IEMP monitoring scope for groundwater, surface water, sediment, air, and biota has been described in detail in Sections 3.0 through 7.0. The summary that follows is intended to provide a synopsis of and basis for each media-monitoring program. Evaluation of each program will form the basis for any IEMP program modifications in the future.

Groundwater: The groundwater monitoring program for the Great Miami Aquifer provides for monitoring water quality in approximately 120 and water levels in approximately 134 existing monitoring wells distributed over the aquifer restoration area, along the FEMP's downgradient property boundary, and at a few private well locations. These wells provide a monitoring network to track the progress of the aquifer restoration and monitor groundwater quality in the area of the on-site disposal facility. The analytical regime for this monitoring program is based on the final remediation levels (FRLs) documented in the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996b).

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Surface Water: The surface water and treated effluent monitoring program is designed to assess the impacts of FEMP remediation activities on surface water. The non-radiological discharge monitoring and reporting related to the National Pollutant Discharge Elimination System (NPDES) Permit have been incorporated into the IEMP. The radiological discharge monitoring related to the Federal Facility Compliance Agreement (FFCA) has been incorporated into the IEMP. All constituents that exceeded FRLs and/or benchmark toxicity values will be monitored. There are 15 monitoring locations.

Sediment: The sediment sampling program consists of 16 monitoring locations for key site-specific radiological constituents. It is designed to determine whether substantial changes to current residual contaminant conditions occur in the sediment along the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River, as a result of runoff and treated effluent from the site.

Air: The air monitoring program consists of three distinct sampling elements: approximately 20 airborne particulate monitoring stations, 34 radon monitoring locations, and 32 direct radiation monitoring locations, with each element supported by the meteorological monitoring program. Each element has a network of monitoring locations on site, at the FEMP boundary, and off site that are used to measure the collective sitewide effects of remediation activities. Data from airborne particulate monitoring will be used to refine emissions estimates for future remediation activities. The analytical regime for the air monitoring program focuses on the principle contaminants of each monitoring element.

Biota: The biota monitoring program consists of the analysis of produce samples from approximately 14 local farms and gardens in order to address FEMP stakeholder concerns regarding this secondary pathway. Frequency of sampling is once every three years, with the next sampling scheduled for the summer of 2003. All samples are analyzed for uranium, the principle contaminant of concern.

8.2.3 Program Review and Revision

As stated in Section 1.0, the IEMP is a "living document" and, as such, is anticipated to change over the life of the FEMP's remediation program. This approach to developing the IEMP acknowledges the dynamic nature of the remediation effort, allowing the plan to focus on the current and evolving mix of FEMP remediation activities from year to year that accompany the FEMP's accelerated site remediation schedule.

To facilitate timely changes to the IEMP program, a structured schedule of annual reviews and biennial revisions has been incorporated into the IEMP. This schedule meets the requirements of DOE Order 5400.1 for review and revision of environmental monitoring plans. Annual reviews will evaluate the current IEMP program against the anticipated mix of remediation activities scheduled to occur in the subsequent two years. The annual review cycle provides the mechanism for identifying and initiating any program modifications that are necessary to align the IEMP with the mix of near-term remediation activities. For example, constituent selection and sample locations, frequency, and media will be reviewed and evaluated annually. Any resultant modifications to the IEMP will be communicated to the regulatory agencies.

The two-year revision will incorporate all changes initiated as a result of the annual review process. The revision also will identify any program modifications necessary as a result of progressive findings of the IEMP and any changes to existing regulatory agreements or requirements applicable to sitewide monitoring. This submittal is the second biennial IEMP revision.

In addition to the IEMP-sponsored review and revision obligations identified above, an independent review and assessment mechanism exists through the Cost Recovery Grant reached between the Ohio Environmental Protection Agency (OEPA) and DOE. The Cost Recovery Grant provides an avenue for OEPA to conduct an independent review of DOE environmental monitoring programs. OEPA's role, as defined in the Cost Recovery Grant, is to independently verify the adequacy and effectiveness of DOE's environmental monitoring programs through program review and independent data collection. Results of the OEPA review are summarized in an annual report that will be considered during the IEMP annual review process. Modifications to the scope or focus of the IEMP, as a result of OEPA's activities, will be incorporated as necessary via the annual IEMP review process.

8.3 REPORTING

As stated in Section 1.0, a primary objective of the IEMP is to successfully integrate the numerous routine environmental reporting requirements under a single comprehensive framework. The IEMP provides the vehicle to centralize, streamline, and focus sitewide environmental monitoring and associated reporting under a single controlling document.

8.3.1 Regulatory Drivers for Reporting Monitoring Data

An analysis of regulatory drivers and policies was conducted by examining ARARs within each of the operable unit's record of decision, FEMP compliance agreements, and DOE Orders applicable to monitoring each media. These regulatory drivers are identified in Sections 3.0 through 7.0 of the IEMP and were evaluated for reporting requirements. The following reporting drivers are in the IEMP reporting strategy:

- DOE Order 5400.1, General Environmental Protection Program Requirements, which requires DOE facilities to submit annual site environmental reports that summarize the environmental monitoring data results
- The September 10, 1993, OEPA Director's Findings and Orders (OEPA 1993), which requires submittal, by March 1 of each year, of groundwater monitoring data collected over the previous year in Resource Conservation and Recovery Act (RCRA) annual reports, to fulfill RCRA/Ohio hazardous waste regulations for groundwater monitoring
- The current NPDES Permit for the FEMP, which requires monthly reports to demonstrate compliance with provisions in the NPDES Permit
- The 1986 FFCA, which, per an agreement made with U.S. Environmental Protection Agency (EPA) and OEPA in January 1996, requires submittal of quarterly progress reports
- National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 Code of Federal Regulations 61, Subpart H, which requires submittal of an annual NESHAP report to demonstrate compliance with emission standards for radionuclides other than radon
- The Federal Facility Agreement (FFA), Control and Abatement of Radon-222 Emissions, signed November 19, 1991, which requires, per an agreement made with EPA and OEPA in January 1996, submittal of the continuous air monitoring data in selected on-site areas in a quarterly progress report.

8.3.2 Reporting Responsibilities

Under the IEMP consolidated reporting concept, each project will be responsible for maintaining records of its project-specific monitoring program and reporting the data as defined in the appropriate project-specific controlling document. Concurrently, the data generated by sitewide environmental monitoring will be maintained and managed by the IEMP program. Project-specific data and interpretations thereof are being transmitted to the IEMP program to status the regulators, to support the annual review and biennial revision to the IEMP, and to support IEMP-sponsored annual integrated site environmental reports. IEMP data are communicated to the projects as warranted by evaluation of the IEMP data.

8.3.3 IEMP Reporting

This revision to the IEMP documents a change in the method of reporting IEMP data. The new IEMP reporting format emphasizes timely data reporting and streamlined quarterly submittals. This is a change from the past, when the reporting of IEMP data from a set timeframe (i.e., a quarter) was delayed until the data could be consolidated into a comprehensive report. The revised reporting format also recognizes that differences exist between the level of information required by the regulatory agencies and the public. To meet the needs of the regulatory agencies, a password-protected IEMP Extranet Site will be setup to allow more timely access to IEMP data. Brief quarterly summaries will be submitted approximately one month after the end of each quarter. These quarterly summaries will supplement the IEMP Extranet Site by identifying and summarizing data added to the site during that quarter. To meet the information needs of the public, the existing Environmental Monitoring Internet site (accessible through www.fernald.gov) will be modified to provide the most current data from key IEMP programs of interest to the general public. The IEMP annual integrated site environmental reports, along with the accompanying appendices, will continue to be submitted to provide a comprehensive annual evaluation of IEMP data for both the regulatory agencies and the public.

The IEMP Extranet Site

The IEMP Extranet Site will allow the regulatory agencies access to IEMP data in a more timely manner, and will serve as the focus of ongoing IEMP data reporting. The data will be available to the agencies on the IEMP Extranet Site after analysis, analytical validation, entry into FEMP data systems, and review by environmental media personnel. These data will be provided in the format of downloadable data files, and in some cases, the data will also be searchable on the site. The IEMP Extranet Site data files will also include a comment field that can be used to flag certain results, or provide the reason that a result is not available. The use of the Extranet Site as the primary mechanism for reporting IEMP data to the agencies will reduce the lag time by up to several months from previous IEMP quarterly status reports. The time lag will decrease even more for biota and sediment data, previously only available through IEMP annual integrated site environmental reports.

Quarterly Summaries

The quarterly summaries represent a notable change from the previous IEMP quarterly status reports. These brief submittals will not attempt to consolidate data from a monitoring period (i.e., a quarter), nor will they provide in-depth discussion and interpretation of IEMP data. The quarterly summaries will

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serve as an accompaniment to the data on the IEMP Extranet Site by identifying the data added to the site during the quarter's timeframe. This will include some data (primarily non-analytical) collected to support IEMP programs from the current quarter, and the data (primarily analytical) collected to support IEMP programs from previous quarters that were not yet available on the IEMP Extranet Site until the current quarter. Also, the quarterly summaries will identify any notable results or events related to the IEMP data covered. Notable results might include unexpected FRL (or other action level) exceedances, results that show an upward trend and may cause concern, suspect results, etc. Of note, all data covered under a quarterly summary will have been available to the regulatory agencies for approximately one month or more before issuing the report. In addition, any notable events that could impact an IEMP program will have already been discussed with the regulatory agencies during weekly conference calls, or otherwise. The purpose of these summaries is to serve as documentation of when IEMP data were available and when related events took place to guide regulatory review of data on the IEMP Extranet Site. They will be submitted to the regulatory agencies for informational purposes, and will not be subject to regulatory review and comment.

Annual Integrated Site Environmental Reports

The IEMP annual integrated site environmental reports will continue to be submitted on June 1 of each year. This report will remain essentially the same as in years past, serving as the comprehensive report for a full calendar year of IEMP data. It will continue to document the technical approach and data reported for the groundwater (including the on-site disposal facility), surface water, sediment, air, and biota monitoring programs, and will summarize CERCLA, RCRA, and waste management activities. The summary report serves the needs of both the regulatory agencies and the public. The accompanying, detailed appendices compile the information reported on the IEMP Extranet Site, and are intended for a more technical audience including the regulatory agencies.

Environmental Monitoring Internet Site

To specifically meet the information needs of the public, the Environmental Monitoring page of the Fernald Internet Site (accessible through www.fernald.gov) will be modified to report the data from only the environmental monitoring programs of interest to the general public. The programs that are of interest to the general public were established as those that have historically generated questions/comments during pubic meetings or comment periods. The following IEMP programs will have data included on the Internet Site:

- Total uranium surface water discharges
- Fenceline radon concentrations
- Total radiation dose.

This Internet site will present these data in simple and easily understandable manner, and would not be subject to regulatory review and comment. Results from these programs will be updated as data become available, and will be presented as they relate to the established action levels. If the need arises based on public input or concerns, additional IEMP data or information could be added to this site.

Figure 8-1 identifies the media that are being reported under the IEMP umbrella and the associated calendar schedule. As previously identified, because the IEMP is a "living document," a structured schedule of annual reviews and two-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any groundwater program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current mix of near-term remediation activities. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

FIGURE 8-1

IEMP REPORTING SCHEDULE FOR 2001 AND 2002

	2001[a]											
	First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GROUNDWATER[b]	✶	✶	✶	✶ ♦	✶	✶ ✪	✶ ♦	✶	✶	✶ ♦	✶	✶
SURFACE WATER[c]	✶	✶	✶	✶ ♦	✶	✶ ✪	✶ ♦	✶	✶	✶ ♦	✶	✶
NPDES Permit Compliance	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧
SEDIMENT[d]						✪					✶	
BIOTA[e]						✪						
AIR[f]	✶	✶	✶	✶ ♦	✶	✶ ✪	✶ ♦	✶	✶	✶ ♦	✶	✶

	2002[a]											
	First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GROUNDWATER[b]	✶ ♦	✶	✶	✶ ♦	✶	✶ ✪	✶ ♦	✶	✶	✶ ♦	✶	✶
SURFACE WATER[c]	✶ ♦	✶	✶	✶ ♦	✶	✶ ✪	✶ ♦	✶	✶	✶ ♦	✶	✶
NPDES Permit Compliance	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧	✧
SEDIMENT[d]	♦					✪					✶	
BIOTA[e]												
AIR[f]	✶ ♦	✶	✶	✶ ♦	✶	✶ ✪	✶ ♦	✶	✶	✶ ♦	✶	✶

✶	= Extranet Reporting
✧	= Monthly Reporting
♦	= Quarterly Summary
✪	= Annual Reporting

[a]There is a time lag for reporting analytical results because of the time needed for analysis, analytical validation, entry into FEMP data systems, and review by environmental media personnel.
[b]Encompasses aquifer restoration operational assessment, aquifer conditions, and on-site disposal facility groundwater monitoring
[c]Encompasses NPDES, FFCA, and IEMP characterization monitoring
[d]Sediment data are collected annually, and will be added to the IEMP Extranet Site as they become available. This data will be covered in the following quarterly summary, and in the annual integrated site environmental report.
[e]Biota (i.e., produce), which is sampled every three years, was sampled in the summer of 2000 and will be reported in the 2000 Integrated Site Environmental Report to be issued in June 2001. The next sample event is scheduled for the summer of 2003.
[f]Encompasses all air monitoring programs including FFA and NESHAP Subpart H

References

REFERENCES

Aller, L., T.W. Bennet, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, D.M. Nielson, J.E. Denne, 1989, Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA Base 600/4-89/034, National Water Well Association, Columbus, OH.

American National Standards Institute, 1975, "American National Standards Institute - Performance, Testing and Procedural Specifications for Thermoluminescent Dosimetry: Environmental Applications," ANSI N545-1975.

FERMCO 1995, "Fernald Site Environmental Monitoring Plan, Revision 2," PL-1002, prepared for U.S. Department of Energy, Fernald Field Office, Cincinnati, OH.

Ohio Environmental Protection Agency, 1993, "Ohio EPA Director's Final, Findings and Orders, in the Matter of: U.S. Department of Energy, Fernald Environmental Management Project, P.O. Box 398704, Cincinnati, OH 45239," Ohio EPA, Columbus, OH.

U.S. Dept. of Energy, 2000a, "Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Cincinnati, OH.

U.S. Dept. of Energy, 2000b, "Re-Injection Demonstration Test Report for the Aquifer Restoration and Wastewater Project," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Cincinnati, OH.

U.S. Dept. of Energy, 1999, "Integrated Environmental Monitoring Plan, Revision 1," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1998a, "Sitewide CERCLA Quality Assurance Project Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1998b, "Sitewide Excavation Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997a, "Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1)," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997b, "Integrated Environmental Monitoring Plan, Revision 0," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997c, "On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997d, "Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997e, "Restoration Area Verification and Sampling Program, Project Specific Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1996a, "Phase VII Removal Actions and Reporting Requirements Under the Fernald Environmental Management Project Legal Agreements," letter DOE-0395-96 from Johnny Reising, U.S. DOE to James A. Saric, U.S. EPA, and Tom Schneider, Ohio EPA, dated January 16, 1996.

U.S. Dept. of Energy, 1996b, "Record of Decision for Remedial Actions at Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1996c, "Remedial Design Work Plan for Remedial Actions at Operable Unit 5," Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1995a, "Characterization of Background Water Quality for Streams and Groundwater Report," Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1995b, "Feasibility Study Report for Operable Unit 5," Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1995c, "Proposed Plan for Operable Unit 5," Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1995d, "Remedial Investigation Report for Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1993, "Routine Groundwater Monitoring Program Along the Downgradient Boundary of the FEMP," Revision 1, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1992, "The Work Plan for the South Contaminated Plume Removal Action," Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1991, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance," DOE/EH-0173T, Assistant Secretary for Environment, Safety and Health, Washington, DC.

Appendix A

APPENDIX A

DETAILED EXPLANATION OF CONSTITUENT SELECTION FOR GROUNDWATER MONITORING

APPENDIX A

DETAILED EXPLANATION OF CONSTITUENT SELECTION FOR GROUNDWATER MONITORING

A.1 INTRODUCTION

As described in Section 3.0 of the Integrated Environmental Monitoring Plan (IEMP), the groundwater monitoring program for 2001 and 2002 for the Great Miami Aquifer consists of 120 monitoring wells. These wells are distributed over four restoration modules, the Plant 6 area, along the Fernald Environmental Management Project's (FEMP's) downgradient property boundary, and at three private well locations. These wells provide an extensive monitoring network that will allow module-specific performance measures to be tracked and provide assurance that contaminants are not migrating beyond the groundwater restoration area that is defined by the sitewide hydraulic capture zone of the FEMP. Because of the extensive nature of this system, it is important to recognize that if all of these wells were monitored quarterly for the full suite of the FEMP's groundwater final remediation level (FRL) constituents (50 constituents total), the analytical costs alone would exceed 16 million dollars over the life of the FEMP's groundwater restoration program. Clearly, these costs are prohibitive, and it is not cost-effective to monitor the full suite of constituents at each successive monitoring interval at all available wells during the active remediation process.

The intent of this appendix is to develop a cost-effective, representative list of analytical constituents that can be used to successfully track the progress of the remedy, satisfy regulatory requirements, and ultimately determine when remediation activities are complete for each module. The FEMP recognizes its obligation to verify that all 50 FRL constituents are below their corresponding FRL values in order to deem the remediation activities as complete. During the active remediation process, the FEMP is proposing to track the progressive success of the remedy using a logical "short list" of zone-specific indicator constituents (developed through the methodology described in this appendix), and then verify the completion for the remedy (step-wise for each module, as appropriate) using the full suite of 50 FRL constituents as identified in the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996). In accordance with the current scope and revision cycles of the IEMP, this appendix primarily focuses on the development of analytical constituents that can support the next two years of monitoring efforts for the aquifer (2001 and 2002). Subsequent versions of the IEMP are expected to focus on the monitoring activities and the constituents needed to support a collective decision on the part of U.S. Department of Energy, U.S. Environmental Protection Agency (EPA), and Ohio Environmental Protection Agency (OEPA) that remediation activities are complete for each module. Later versions will also define the FEMP's long-term groundwater monitoring activities (on-site disposal facility) that may extend beyond completion of the restoration program.

The remainder of the appendix is organized into the following sections:

- Objectives: defines the overall constituent selection strategy for groundwater monitoring over the life of the remedy, along with the specific intentions and needs to support the next two years of activity
- Approach: defines the constituent selection criteria and describes the historical information reviewed to develop zone-specific lists that are responsive to regulatory requirements and the remedy performance tracking needs
- Results: presents the aquifer zone-specific constituents and sampling frequencies that will support the next two years of monitoring activities
- Future Activities: defines the process for modifying and revising the lists as needed to support future versions of the IEMP and ultimate completion of the Operable Unit 5 groundwater remedy.

A.2 OBJECTIVES

The objective of the selection process is to develop a cost-effective, representative list of constituents that can be used to successfully track the progress of the remedy, satisfy regulatory commitments, and ultimately determine when restoration activities are complete for each module. This section presents the strategy used to meet this objective.

Restoration of the aquifer will be measured by the achievement of the FEMP's 50 groundwater FRLs. FRLs for the aquifer are presented in the Operable Unit 5 Record of Decision for 50 constituents of concern. Developed during the remedial investigation/feasibility study process, these 50 FRL constituents either:

- Have concentrations that have been detected in the aquifer
- Have the potential to reach the aquifer within 1,000 years (assuming no source control actions are in place) and pose an unacceptable risk to human health and/or the environment.

The development of FRLs is presented in Section 2.0 of the Feasibility Study Report for Operable Unit 5 (DOE 1995).

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The 50 FRL constituents have been organized into four categories for the purpose of establishing a constituent hierarchy and identifying a short list of indicator constituents that will be targeted for more frequent monitoring than the other FRL constituents. The objective will be to track all 50 FRL constituents at various intervals throughout the restoration, but to track the short list of indicator constituents more frequently. This approach provides a more cost-effective and realistic method to track remedy performance.

Constituents from each of the four different categories were organized into specific monitoring lists based upon specific monitoring objectives and the geographic locations of the monitoring module/activities. The specific monitoring objectives considered in subdividing the constituents into specific groups are:

- Is the success of the groundwater remedy proceeding satisfactorily at the pace that is desired?
- Are physical adjustments to the restoration system (i.e., flow rates, well locations, etc.) needed?
- Are FRL constituents migrating beyond the hydraulic zone of capture created by the restoration system?
- Are new FRL constituents arriving in the aquifer as a result of vertical migration through the glacial overburden or as a result of surface water infiltration?
- Is sufficient information being gathered to ultimately demonstrate that remedial objectives contained in the Operable Unit 5 Record of Decision have been obtained?
- Have all specific regulatory-based monitoring requirements for specific constituents been satisfied in the selection process?

Figure A-1 illustrates the constituent selection process. The selection process results in a categorization hierarchy that identifies a short list of 10 indicator constituents that will be sampled more frequently to track the progress of the restoration and assess the need for changes in operating conditions as necessary. The remaining constituents will be sampled less frequently to determine whether new FRL exceedances are occurring in the aquifer due to migration through the glacial overburden or surface water and to ultimately demonstrate that remedial objectives are being achieved. Figure A-1 also shows how the categories are organized into the different aquifer zones. The aquifer was divided into five geographic zones to determine zone-specific monitoring lists. Four of these five zones correspond to the restoration modules. The fifth zone (Aquifer Zone 0) consists of the areas outside Aquifer Zones 1 through 4. Figure A-2 depicts the five aquifer zones.

A.3 APPROACH

This section on approach defines the constituent selection criteria, and describes the historical information reviewed to develop zone-specific lists that are responsive to regulatory requirements and the remedy performance tracking needs. These criteria are used to divide the 50 FRL constituents into four categories for monitoring the aquifer restoration as follows:

- Using data collected between 1988 through 1999, FRL constituents with at least one FRL exceedance in the aquifer are grouped together and identified using a ">" symbol. FRL constituents that do not have a FRL exceedance in the aquifer are grouped together and identified using a "<" symbol. The 1988 through 1995 set comprised of validated data has been supplemented with both validated and non-validated data from 1996 through 1999 to determine the occurrence of exceedances.

- FRL constituents predicted to have the ability to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and/or the environment are grouped together. These constituents are considered "mobile and persistent", and are identified using the letters "MP". FRL constituents that are predicted not to have the ability to migrate vertically to the aquifer and create an unacceptable risk are grouped together. These constituents are considered not mobile and persistent, and are identified using the letter N".

- FRL constituents that have not been sampled for in the aquifer, but are predicted to be unable to migrate vertically to the aquifer and create an unacceptable risk are categorized as not having a FRL exceedance (<).

- FRL constituents that have not been sampled for in the aquifer, but do have the ability to migrate vertically to the aquifer and create an unacceptable risk are categorized as having a FRL exceedance (>).

- FRL constituents that are common laboratory contaminants and do not have a confirmed FRL exceedance are categorized as not having a FRL exceedance (<).

- FRL constituents analyzed using a method detection limit above the FRL value and predicted to be unable to migrate vertically to the aquifer and create an unacceptable risk are categorized as not having a FRL exceedance (<).

- FRL constituents analyzed using a method detection limit above the FRL value and predicted to have the ability to migrate vertically to the aquifer and create an unacceptable risk are categorized as having a FRL exceedance (>).

After the 50 FRL constituents are identified as being (< or >) and (MP or N), they are grouped into the four categories, >MP, >N, <MP, and <N. The >MP constituents are considered to be the short-list of

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indicator constituents and are targeted for more frequent monitoring. The remaining constituents (>N, <MP, and <N) are targeted for less frequent monitoring.

In addition to monitoring restoration performance, there are regulatory commitments that specify the need to monitor select constituents at specific locations:

- The Paddys Run Road Site constituents are monitored at key locations in the South Plume Module.
- Total uranium is monitored in the FEMP's private well monitoring program.
- Constituents that have caused FRL exceedances in Aquifer Zones 0 through 3 are monitored at the FEMP's downgradient property boundary.

A.4 RESULTS

A.4.1 FRL Constituents that Have Been Detected in the Great Miami Aquifer at a Concentration above their Established FRLs

The Operable Unit 5 remedial investigation/feasibility study data set, supplemented with groundwater data collected in 1994 through 1999, were reviewed to identify constituents that have been detected in the Great Miami Aquifer at concentrations above the established FRLs, and where they occur. The majority of the groundwater data collected in 1994 through 1996 were obtained from the Resource Conservation and Recovery Act Property Boundary Monitoring Program and the South Plume Groundwater Recovery System Design, Monitoring, and Evaluation Program Plan. All filtered and unfiltered samples from Types 2 and 3 monitoring wells were evaluated. Data from Type 4 monitoring wells were not reviewed because, other than uranium at one location, (caused by leaking casing) there were no FRL exceedances related to the FEMP at the Type 4 well depth. The Operable Unit 5 remedial investigation/feasibility study reports that the total uranium plume is located in the upper portions of the aquifer at Types 2 and 3 well depths, and that no uranium plume has been observed at the Type 4 well depth. The lack of contamination attributable to the FEMP at the Type 4 well depth is due to two factors: 1) the contamination entered the aquifer from sources above, resulting in plumes that are most extensive and concentrated at the Type 2 well depth and successively less extensive and concentrated at Types 3 and 4 well depths; and 2) the presence of a clay layer within most of the aquifer in the area of the FEMP at a depth just below the Type 3 well depth. This clay layer has served to limit the downward migration of contamination.

Table A-1 summarizes the results of the data evaluation. Columns 1 through 4 list the FRL constituents, the assigned groundwater FRL value, units for the FRL value, and the basis for the FRL value, respectively. As presented in Section 2.0 of the Operable Unit 5 Feasibility Study Report, the FRLs were developed based on applicable or relevant and appropriate requirements, detection limits, background concentrations, and/or risk assessment results.

Column 5 lists the number of samples included in the data sets. Column 6 lists the number of results (either - , J, or NV) that were detected for each constituent above their established FRLs. Constituents that were not detected in the aquifer at a concentration above their FRL will still be monitored, but not as frequently as those that have been detected.

Column 7 lists, by aquifer zone, the number of wells with FRL exceedances. Using total uranium as an example, 18 wells have shown exceedances of the uranium FRL in Aquifer Zone 4. The last column of the table lists the range of results above the FRL and also provides the validation qualifier (either -, J, or NV).

The data evaluation indicates that:

- Thirty of the 50 FRL constituents have had exceedances of their FRLs in the Great Miami Aquifer at least one time, using data collected from 1988 through 1999. In the IEMP, Revision 1 (DOE 1999b), there were 31 constituents. The reduction is due from removing chromium VI from the monitoring list. Further discussion on its removal is provided later on in this appendix.

- Of the 50 FRL constituents, 2,3,7,8-tetrachlorodibenzo-p-dioxin and octochorodibenzo-p-dioxin, have not been analyzed in every zone. These two constituents are categorized as either having an exceedance or not having an exceedance based upon the criteria presented in the previous section.

- Of the 50 FRL constituents, bis(2-Ethylhexyl)phthalate, had three reported historical FRL exceedances (0.015 milligrams per liter [mg/L], 0.013 mg/L, and 0.007 mg/L) at three different wells. Confirmatory sampling of each exceedance indicated that the result was most likely due to laboratory contamination. In addition, there have been no exceedances during 1996 and 1997; therefore, it was categorized as not having a FRL exceedance.

- Of the 50 FRL constituents, aroclor-1254, bis(2-Chloroisopropyl)ether, chloroethane, and octochlorodibenzo-p-dioxin, have been analyzed using a method detection limit above the FRL value. These four constituents were categorized as either having an exceedance or not having an exceedance based upon criteria presented in the previous section.

Figures A-3 through A-33 illustrate, by constituent, where FRL exceedances have occurred. The figures also show the modeled hydraulic capture zone associated with the accelerated aquifer remediation scenario.

A.4.2 Constituents that Could Migrate to the Great Miami Aquifer Through the Glacial Overburden

A constituent's ability to migrate vertically to the Great Miami Aquifer through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and/or the environment was also used to categorize the 50 FRL constituents. While at present, the data evaluation of historical results (1988 through 1999) indicates that FRL exceedances in the aquifer have only been detected for 30 of the 50 FRL constituents, it is recognized that a constituent could potentially migrate vertically through the glacial overburden to the aquifer in the future and cause a FRL exceedance.

During the remedial investigation/feasibility study process, the mobility and persistence characteristics of 93 constituents were assessed and modeled to predict which constituents had the ability to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and/or the environment. Table F.2-2 of the Operable Unit 5 Feasibility Study Report presents the results of the model screening process. In order to be conservative, the modeling assumed that no sources of contamination were removed (i.e., the "no-action alternative" was selected for the FEMP).

For the purpose of constituent selection, the terms "mobile and persistent" are used to describe those constituents that are predicted to be able to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk in the absence of the source-control actions (i.e., identified as failing the Operable Unit 5 Feasibility Study model screening in Table F.2-2). These FRL constituents are identified in Column 4 of Table A-2 with the letters "MP". Those FRL constituents that do not have the ability to migrate vertically to the aquifer and create an unacceptable risk (not "mobile and persistent"), are identified in Column 4 of Table A-2 with the letter "N" (identified as passing the Operable Unit 5 Feasibility Study model screening in Table F.2-2).

The first three columns of Table A-2 summarize the information included in Table A-1. The information in Column 4 originated from Table F.2-2 of the Operable Unit 5 Feasibility Study Report.
(Note: Table A-2 is identical to Table 3-2 of the IEMP.)

Chloroethane, 4-nitrophenol, and 2,3,7,8-tetrachlorodibenzo-p-dioxin were not specifically modeled during the Operable Unit 5 Feasibility Study process. The upper range of half-lives found in literature for chloroethane and 4-nitrophenol in groundwater are eight weeks and 9.8 days, respectively (Howard, et. al 1991). Due to these relatively short half-lives, chloroethane and 4-nitrophenol are not expected to reach the aquifer. Although 2,3,7,8-tetrachlorodibenzo-p-dioxin has a half-life of about 3.23 years, dioxin-like compounds are primarily associated with particulate and organic material due to their high lipophilicity and low water solubility, and therefore are not considered mobile. Dioxins exhibit little potential for significant leaching and are not mobile into the aquifer. Therefore, dioxin-like compounds in Table F.2-2 passed the model screening and are not predicted to be able to migrate vertically to the aquifer and create an unacceptable risk. For these reasons, the above three constituents are considered to be not mobile and persistent and assigned "N" in Table A-2 as they either have high degradation rates or low water solubility.

The Operable Unit 5 Feasibility Study modeling predicted that bis(2-Chloroisopropyl)ether and carbazole had the ability to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk in the absence of source control measures. It has since been determined that the decay rate used for these two constituents was overly conservative. This conservative assumption was used because no literature decay half-life was found, at the time, for these two constituents. A recent study (Grosser, et. al 1995) concluded that the degradation rate of carbazole is similar to phenanthrene and anthracene. The upper range of half-lives found in literature for bis(2-Chloroisopropyl)ether in groundwater is one year (Howard, et. al 1991). Additional model screening simulations were conducted using the half-life of anthracene (i.e., five years) for carbazole and one year for bis(2-Chloroisopropyl)ether. Based on the last modeling results, both constituents passed the model screening and are, therefore, not considered to be mobile and persistent. For this reason, these constituents are assigned "N" in Table A-2.

In summary, chloroethane, 4-nitrophenol, 2,3,7,8-tetrachlorodibenzo-p-dioxin, bis(2-Chloroisopropyl)ether, and carbazole are not considered sufficiently mobile and persistent to impact the aquifer. As mentioned, they are assigned the "N" characteristic in Table A-2. It is also important to point out that none of these five constituents have been detected in the aquifer at concentrations above the groundwater FRLs.

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From review of Table A-2, Column 4, it can be determined that:

- Twelve of the 50 constituents (24 percent) are considered mobile and persistent (MP). These constituents are: fluoride, nitrate, boron, mercury, neptunium-237, strontium-90, technetium-99, total uranium, alpha-chlordane, bromodichloromethane, 1,2-dichloroethane, and vinyl chloride. Chromium VI was removed from the monitoring list based on geochemical work conducted in 1999. Further discussion is provided later on in this appendix.

- Thirty-seven of the 50 constituents (74 percent) are considered not mobile and persistent (N).

A.4.3 Zone-Specific Constituent Lists and Sampling Frequencies

Information from Column 3 of Table A-2 was combined with information from Column 4 to produce four categories (>MP, <MP, >N, <N). Columns 5 through 9 provide a zone-specific sort of how each FRL constituent is categorized. The constituents were categorized, by aquifer zone, based on the following four characteristics:

- >MP The constituent has been detected in the aquifer at concentrations greater than its established FRL and is considered "Mobile and Persistent." It has been predicted to be able to migrate vertically from the glacial overburden to the aquifer and has already caused a FRL exceedance in the aquifer.

- >N The constituent has been detected in the aquifer at concentrations greater than its established FRL but is "Not considered mobile and persistent." This constituent is not predicted to be able to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk. Background conditions and/or surface water infiltrations may be the cause of the isolated FRL exceedances noted in the historical record.

- <MP The constituent has not been detected is the aquifer at concentrations greater than its established FRL, but is considered both "Mobile and Persistent." This constituent is predicted to be able to migrate vertically through the glacial overburden to the aquifer (if no source removal/control actions are taken), but as yet has not caused exceedances of its established FRL.

- <N The constituent has not been detected is the aquifer at concentrations greater than its established FRL and is "Not considered mobile and persistent."

A zone-specific breakdown of the number of constituents in each of the four categories is presented below.

BREAKDOWN OF FRL CATEGORY CONSTITUENTS BY AQUIFER ZONE

Constituent Category	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
>MP	7	6	5	4	6
>N	14	16	13	14	18
<MP	5	6	7	8	6
<N	23	21	24	23	19

The nine short list constituents that are categorized as ">MP" in at least one aquifer zone are:

- Fluoride
- Nitrate
- Boron
- Mercury
- Neptunium-237
- Strontium-90
- Technetium-99
- Uranium, Total
- 1,2-Dichloroethane.

These constituents are considered to be the master short list of indicator constituents from which zone-specific short lists were developed. These short list constituents will be monitored more frequently than the other constituents in order to track the progress of the remedy. These constituents have been detected in the aquifer at concentrations above their established FRLs and they are both mobile and persistent.

Each of the four categories of constituents will be targeted for monitoring at the following frequency:

- >MP Constituents are to be monitored quarterly in source areas and at the property boundaries because they have been detected in the Great Miami Aquifer above their established FRL and are considered mobile and persistent.

- >N Constituents are to be monitored quarterly at the property boundaries so that sufficient data will be available to evaluate water quality trends. Constituents are to be monitored annually in source areas because they have been detected in the Great Miami Aquifer above their established FRL and because they are not considered mobile and persistent.

- <MP Constituents are to be monitored annually because they have not been detected in the Great Miami Aquifer above their established FRL and because they are considered mobile and persistent.

- <N Constituents are to be monitored every five years to verify that these lowest-priority FRL constituents remain below their established FRL.

Exception:

- The constituents with the >MP characteristic in the Plant 6 area will be monitored semiannually instead of quarterly.

Monitoring lists were developed using Columns 5 through 9 of Table A-2. The specific constituent lists can be found in Section 3.5.1 and 3.5.2 of the IEMP. Columns 5 through 9 indicate how constituents have been categorized for each aquifer zone. The assignment of aquifer zones for monitoring FRL constituents is as follows:

- South Plume Module is monitored in Aquifer Zones 2 and 4.
- South Field Module is monitored in Aquifer Zone 2.
- Waste Storage Area Module is monitored in Aquifer Zone 1.
- Plant 6 area is monitored in Aquifer Zone 3.
- Property Boundary Monitoring wells monitor downgradient of Aquifer Zones 0 through 3.

Exceptions:

- Private well monitoring and Paddys Run Road Site Activity of the South Plume Module have established constituent lists that were put together to meet specific objectives. These will be maintained as discussed in Section 3.5 of the IEMP.

Although the FRLs listed in Table 9-3 of the Operable Unit 5 Record of Decision were developed for nitrate, future monitoring modules/programs will be analyzed for nitrate/nitrite. This was done to facilitate laboratory procedures and minimize cost. The constituent for which the FRL was developed is a portion of what will be analyzed.

In addition to the analytical constituents, several field parameters will be monitored during each groundwater sample collection event. These field parameters include dissolved oxygen, pH, specific conductance, temperature, and turbidity. They serve as indicators of aquifer conditions and are used to verify that groundwater samples are representative.

A.5 FUTURE ACTIVITIES

A.5.1 Modifying Constituent Lists

Each year the monitoring lists will be updated with the previous year's data and re-evaluated using the same logic previously outlined in this appendix. The new data collected may indicate that it is necessary to increase or decrease the monitoring frequency for some of the constituents. The following are conditions that would indicate the potential need to modify specific sampling frequencies. In general, if in any aquifer zone, a constituent is categorized as:

- <MP becomes >MP - indicating a FRL exceedance - increase sampling frequency to quarterly
- <N becomes >N - indicating a FRL exceedance - increase sampling frequency to annual
- >MP becomes <MP - indicating no longer a FRL exceedance - decrease sampling frequency to annual
- >N becomes <N - indicating no longer a FRL exceedance - decrease sampling frequency to every five years.

Note: As identified earlier, monitoring in the Plant 6 area along with the Property Boundary Activity has some exceptions to the above monitoring frequencies.

The specific criteria to be used to change sampling frequencies are presented below.

The following criteria would trigger a sampling frequency increase:

- A <MP constituent is routinely sampled annually. Two consecutive FRL exceedances will result in the <MP constituent of interest being re-categorized to a >MP constituent for the affected aquifer zone. An evaluation of each specific exceedance will be conducted to determine if re-sampling ahead of the regularly scheduled sampling is warranted.
- A <N constituent is routinely sampled once every five years. Two consecutive FRL exceedances will result in the <N constituent of interest being re-categorized to a >N constituent for the affected aquifer zone. An evaluation of each specific exceedance will be conducted to determine if re-sampling ahead of the regularly scheduled sampling is warranted.

The following criteria would trigger a sampling frequency decrease:

- A >MP constituent is routinely sampled quarterly. If sampling results for four consecutive quarters indicate that the constituent's concentrations are lower than the FRL for an entire aquifer zone, then the aquifer zone will be re-categorized as <MP for that specific constituent and monitoring will be decreased to annually.

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- A >N constituent is routinely sampled annually. If two consecutive sampling results indicate that the constituent's concentration are lower than the FRL for an entire aquifer zone, then the aquifer zone will be re-categorized as <N for that specific constituent and monitoring will be decreased to once every five years.

Modifying and revising constituent lists and sampling locations will be an ongoing process for the groundwater-monitoring program, as more data are obtained and trends become apparent. Formal revisions to the IEMP will occur every two years and annual modifications will be identified in IEMP annual integrated site environmental reports. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA via the quarterly reporting process. No constituent will be removed from a sampling list until EPA and OEPA have concurred with the decision.

A.5.2 Sampling for Chromium VI

As reported in the 1998 Integrated Site Environmental Report (DOE 1999a), chromium VI is not present in the aquifer at the FEMP and Eh-pH conditions measured in the aquifer are not oxidizing enough to support the presence of chromium VI. For this reason it is proposed that chromium VI be removed from the IEMP groundwater-monitoring program.

Since 1996, total chromium has been conservatively sampled for in groundwater samples. This practice was adopted to facilitate short holding times required for the analysis of chromium VI. This practice has also resulted in several false positive chromium VI FRL exceedances. Although chromium VI was removed from the monitoring lists, it is still listed as a groundwater FRL constituent in the Operable Unit 5 Record of Decision. Steps need to be taken to address chromium VI in the Operable Unit 5 Record of Decision.

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TABLE A-1

GROUNDWATER FRL EXCEEDANCES BASED ON SAMPLES AND LOCATIONS

Constituents	Groundwater FRL[a]	Units	Basis for FRL[b]	No. of Samples[c]	No. of Samples > FRL[c,d]	Zones with FRL Exceedances (No. of Wells with exceedances in each Aquifer Zone)[c,d]	Range Above FRL[c,d]
Uranium, Total	20	µg/L	A	3327	790	0(3) 1(20) 2(44) 3(6) 4(23)	20.6 -/2070 -
Zinc	0.021	mg/L	B	1220	162	0(22) 1(26) 2(25) 3(14) 4(10)	0.0216 J/3.78 -
Arsenic	0.050	mg/L	A	2571	86	0(13) 1(2) 2(4) 3(2) 4(8)	0.0507 -/0.55 -
Manganese	0.90	mg/L	B	1966	89	0(8) 1(9) 2(11) 3(9) 4(6)	0.917 -/139 -
Lead	0.015	mg/L	A	1811	45	0(9) 1(6) 2(11) 3(4) 4(7)	0.0155 J/0.3 -
Nitrate[e]	11	mg/L	B	1674	46	0(9) 1(14) 2(1) 4(2)	11.1 J/331 -
Thorium-228	4.0	pCi/L	R*	1933	35	0(9) 1(1) 2(10) 3(2) 4(5)	4.01 -/14.2 J
Antimony	0.0060	mg/L	A	1207	28	0(5) 1(7) 2(4) 3(3) 4(3)	0.01 -/41.2 J
Nickel	0.10	mg/L	A	1835	36	0 (3) 1(5) 2(8) 3(2) 4(4)	0.103 -/1.42 -
Technetium-99	94	pCi/L	R*	1929	25	0(1) 1(8)	100 J/5510 -
Cadmium	0.014	mg/L	B	1814	18	0(4) 1(5) 2(1) 3(6) 4(2)	0.0147 J/3 -
Vanadium	0.038	mg/L	R	1426	20	0(3) 1(5) 2(1) 3(3) 4(5)	0.0382 -/0.29 -
Mercury	0.002	mg/L	A	2253	14	0(5) 1(4) 2(1) 3(1) 4(3)	0.0023 J/0.0139 J
Strontium-90	8.0	pCi/L	A	1575	9	0(2) 1(1) 3(2) 4(1)	8.14 J/38.5 -
Thorium-232	1.2	pCi/L	R*	1812	9	0(4) 2(4) 4(1)	1.3 -/2.73 -
Carbon disulfide	0.00555	mg/L	A	1186	10	0(1) 1(6) 2(1) 3(1)	0.008 J/0.026 J
Trichloroethene	0.0050	mg/L	A	1318	9	0(1) 1(2) 2(1) 4(1)	0.007 -/0.15 -
Selenium	0.05	mg/L	A	1792	5	1(1) 2(2) 3(1) 4(1)	0.192 -/0.246 -
Neptunium-237	1.0	pCi/L	R*	1529	4	0(2) 2(1) 4(1)	1.46 J/3.25 J
Silver	0.050	mg/L	A	1762	4	0(1) 1(1) 4(2)	0.0598 -/0.12 -
Beryllium	0.0040	mg/L	A	1159	3	1(1) 3(1) 4(1)	0.13 -/0.178 -
Cobalt	0.17	mg/L	R	1162	3	1(1) 3(1) 4(1)	0.404 -/0.528 -
Molybdenum	0.10	mg/L	A	1161	6	1(1) 3(1)	0.2 -/0.69 -
Barium	2.0	mg/L	A	1383	2	4(1)	3.11 -/8.69 -
Fluoride	4	mg/L	A	1941	4	0(2) 1(1) 3(1)	5.3 -/23 J
Benzene	0.0050	mg/L	A	1217	1	0(1)	0.16 J
1,1-Dichloroethene	0.0070	mg/L	A	1023	1	4(1)	0.11 -
1,2-Dichloroethane	0.0050	mg/L	A	1023	1	4(1)	.0.31 -
Radium-226	20	pCi/L	A	1365	1	4(1)	39.8 -
1,1-Dichloroethane	0.28	mg/L	A	705	0	NA	NA
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.000010	mg/L	D	19	0[f]	NA	NA
4-Methylphenol	0.028	mg/L	R	179	0	NA	NA
4-Nitrophenol	0.32	mg/L	R	178	0	NA	NA

TABLE A-1
(Continued)

Constituents	Groundwater FRL[a]	Units	Basis for FRL[b]	No. of Samples[c]	No. of Samples > FRL[c,d]	Zones with FRL Exceedances (No. of Wells with exceedances in each Aquifer Zone)[c,d]	Range Above FRL[c,d]
alpha-Chlordane	0.0020	mg/L	A	427	0	NA	NA
Aroclor-1254	0.00020	mg/L	D	130	0[g]	NA	NA
bis(2-Chloroisopropyl)ether	0.0050	mg/L	D	231	0[g]	NA	NA
bis(2-Ethylhexyl)phthalate	0.0060	mg/L	A	180	0[h]	NA	NA
Boron	0.33	mg/L	R	934	10	2 (2)	0.331 -/1.16 -
Bromodichloromethane	0.10	mg/L	A	991	0	NA	NA
Bromomethane	0.0021	mg/L	R	673	0	NA	NA
Carbazole	0.011	mg/L	R	249	0	NA	NA
Chloroethane	0.0010	mg/L	D	676	0[g]	NA	NA
Chloroform	0.10	mg/L	A	677	0	NA	NA
Copper	1.3	mg/L	A	1325	0	NA	NA
Methylene chloride	0.0050	mg/L	A	705	0	NA	NA
Octachlorodibenzo-p-dioxin	0.00000010	mg/L	D	15	0[g]	NA	NA
Radium-228	20	pCi/L	A	1314	0	NA	NA
Thorium-230	15	pCi/L	R*	1468	0	NA	NA
Vinyl chloride	0.0020	mg/L	A	993	0	NA	NA

[a]From Operable Unit 5 Record of Decision, Table 9-4
[b]From Operable Unit 5 feasibility study, Table 2-16:
A - ARAR based
B - Based on 95th percentile background concentrations
D - Based on lowest achievable detection limit
R - Risk based Preliminary Remediation Goal (PRG)
R*- Risk based Preliminary Remediation Level includes the radionuclide risk-based PRG plus its 95th percentile background concentration.
[c]Based on filtered and unfiltered samples from the Operable Unit 5 remedial investigation/feasibility study data set and 1994 through 1999 groundwater data
[d]Sample results having a -, J, or NV (1996 through 1999) qualifier were used:
- = result is confident as reported
J = result is quantitatively estimated
NV = result is not validated
NA = not applicable
[e]Nitrate results have been evaluated prior to 1996. In 1996, 1997, and in future years, nitrate/nitrite results have been and will be evaluated.
[f]Categorized as not having a valid FRL exceedance because it does not have the ability to migrate vertically to the aquifer and create an unacceptable risk
[g]Analyses of constituent had method detection limit above FRL value.
[h]This constituent showed FRL exceedances in three samples from data collected between 1988 and 1995 (0.015- mg/L, Well 3043 in Aquifer Zone 1; 0.013- mg/L, Well 3016 in Aquifer Zone 2; 0.007J mg/L, Well 2037 in Aquifer Zone 3). Confirmatory sampling indicated that each exceedance was due to laboratory contamination. No exceedances occurred in 1996 through 1999.

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TABLE A-2

CATEGORIZATION OF GROUNDWATER FRL CONSTITUENTS BASED ON EXCEEDANCES, MOBILITY, AND PERSISTENCE

Constituents	Groundwater FRL[a]	Zones with Groundwater Concentrations > FRL[b]	Mobility/Persistence Characteristic[c]	Categorization by Aquifer Zone[d]				
				Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
General Chemistry:	**mg/L**							
Fluoride	4	0,1,3	MP	≥MP	≥MP	<MP	≥MP	<MP
Nitrate	11	0,1,2,4	MP	≥MP	≥MP	≥MP	<MP	≥MP
Inorganics:	**mg/L**							
Antimony	0.0060	0,1,2,3,4	N	>N	>N	>N	>N	>N
Arsenic	0.050	0,1,2,3,4	N	>N	>N	>N	>N	>N
Barium	2.0	4	N	<N	<N	<N	<N	>N
Beryllium	0.0040	1,3,4	N	<N	>N	<N	>N	>N
Boron	0.33	2	MP	<MP	<MP	≥MP	<MP	<MP
Cadmium	0.014	0,1,2,3,4	N	>N	>N	>N	>N	>N
Cobalt	0.17	1,3,4	N	<N	>N	<N	>N	>N
Copper	1.3	-	N	<N	<N	<N	<N	<N
Lead	0.015	0,1,2,3,4	N	>N	>N	>N	>N	>N
Manganese	0.90	0,1,2,3,4	N	>N	>N	>N	>N	>N
Mercury	0.0020	0,1,2,3,4	MP	≥MP	≥MP	≥MP	≥MP	≥MP
Molybdenum	0.10	1,3	N	<N	>N	<N	>N	<N
Nickel	0.10	0,1,2,3,4	N	>N	>N	>N	>N	>N
Selenium	0.050	1,2,3,4	N	<N	>N	>N	>N	>N
Silver	0.050	0,1,4	N	>N	>N	<N	<N	>N
Vanadium	0.038	0,1,2,3,4	N	>N	>N	>N	>N	>N
Zinc	0.021	0,1,2,3,4	N	>N	>N	>N	>N	>N

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TABLE A-2
(Continued)

Constituents	Groundwater FRL[a]	Zones with Groundwater Concentrations > FRL[b]	Mobility/Persistence Characteristic[c]	Categorization by Aquifer Zone[d]				
				Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Radionuclides:	**pCi/L**							
Neptunium-237	1.0	0,2,4	MP	≥MP	<MP	≥MP	<MP	≥MP
Radium-226	20	4	N	<N	<N	<N	<N	>N
Radium-228	20	-	N	<N	<N	<N	<N	<N
Strontium-90	8.0	0,1,3,4	MP	≥MP	≥MP	<MP	≥MP	≥MP
Technetium-99	94	0,1	MP	≥MP	≥MP	<MP	<MP	<MP
Thorium-228	4.0	0,1,2,3,4	N	>N	>N	>N	>N	>N
Thorium-230	15	-	N	<N	<N	<N	<N	<N
Thorium-232	1.2	0,2,4	N	>N	<N	>N	<N	>N
	µg/L							
Uranium, Total	20	0,1,2,3,4	MP	≥MP	≥MP	≥MP	≥MP	≥MP
Organics:	**mg/L**							
alpha-Chlordane	0.0020	-	MP	<MP	<MP	<MP	<MP	<MP
Aroclor-1254	0.00020	-[f]	N	<N	<N	<N	<N	<N
Benzene	0.0050	0	N	>N	<N	<N	<N	<N
bis(2-Chloroisopropyl)ether	0.0050	-[f]	N[g]	<N	<N	<N	<N	<N
bis(2-Ethylhexyl)phthalate[h]	0.0060	-	N	<N	<N	<N	<N	<N
Bromodichloromethane	0.10	-	MP	<MP	<MP	<MP	<MP	<MP
Bromomethane	0.0021	-	N	<N	<N	<N	<N	<N
Carbazole	0.011	-	N[g]	<N	<N	<N	<N	<N
Carbon disulfide	0.0055	0,1,2,3	N	>N	>N	>N	>N	<N
Chloroethane	0.0010	-[f]	N[h]	<N	<N	<N	<N	<N
Chloroform	0.10	-	N	<N	<N	<N	<N	<N
1,1-Dichloroethane	0.28	-	N	<N	<N	<N	<N	<N
1,1-Dichloroethene	0.0070	4	N	<N	<N	<N	<N	>N

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TABLE A-2
(Continued)

Constituents	Groundwater FRL[a]	Zones with Groundwater Concentrations > FRL[b]	Mobility/Persistence Characteristic[c]	Categorization by Aquifer Zone[d] Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Organics: (Contd.)	**mg/L**							
1,2-Dichloroethane	0.0050	4	MP	<MP	<MP	<MP	<MP	>MP
Methylene chloride	0.0050	-	N	<N	<N	<N	<N	<N
4-Methylphenol	0.029	-	N	<N	<N	<N	<N	<N
4-Nitrophenol	0.32	-	N[h]	<N	<N	<N	<N	<N
Octachlorodibenzo-p-dioxin	0.00000010	-[f,i]	N	<N	<N	<N	<N	<N
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.000010	-[i]	N[h]	<N	<N	<N	<N	<N
Trichloroethene	0.0050	0,1,2,4	N	>N	>N	>N	<N	>N
Vinyl chloride	0.0020	-	MP	<MP	<MP	<MP	<MP	<MP

Note: Highlighting indicates "short list" of constituents.

[a]From Table 9-4 in Operable Unit 5 Record of Decision

[b]0, 1, 2, 3, and 4 indicate the aquifer zone(s) where constituent was detected in the aquifer above the FRL. From Operable Unit 5 remedial investigation/feasibility study data set and 1994 through 1999 groundwater data. - indicates that the constituent was not detected in the aquifer above the FRL.
- indicates that the constituent was not detected in the aquifer above the FRL.

[c]From Operable Unit 5 Feasibility Study Report, Table F.2-2. A constituent that failed modeling (model screening predicted that it has the ability to migrate vertically to the aquifer) is considered mobile and persistent, and is listed as MP. A constituent that passed modeling (model screening indicated that it could not reach the aquifer) is considered not mobile and persistent, and is listed as N.

[d]>MP = Has been detected in the aquifer at concentrations greater than the FRL, and has the ability to migrate vertically to the aquifer.
>N = Has been detected in the aquifer at concentrations greater than the FRL, and does not have the ability to migrate vertically to the aquifer.
<MP = Has not been detected in the aquifer at concentrations greater than the FRL, and has the ability to migrate vertically to the aquifer.
<N = Has not been detected in the aquifer at concentrations greater than the FRL, and does not have the ability to migrate vertically to the aquifer.

[e]Nitrate results have been evaluated prior to 1996. In 1996, 1997, and in future years, nitrate/nitrite results have been and will be evaluated.

[f]Analyses of constituent had method detection limit above FRL, but categorized as not having a valid FRL exceedance because model predictions indicate that it does not have the ability to migrate to the aquifer and create an unacceptable risk.

[g]Failed modeling in F.2-2. Constituent has since been remodeled with updated information and passed modeling. It was therefore assigned an N.

[h]Not in Table F.2-2. Constituent assigned an N based on literature review which shows high degradation rates for chloroethane and 4-nitrophenol and low water solubility for 2,3,7,8 tetrachlorodibenzo-p-dioxin.

[i]Categorized as not having a valid FRL exceedance because it does not have the ability to migrate to the aquifer and create an unacceptable risk.

REFERENCES

Grosser, R.J., D. Warshawsky, and J.R. Vestal, 1995, "Mineralization of Polycyclic and N-Heterocyclic Aromatic Compounds in Hydrocarbon-Contaminated Soils," Environmental Toxicology and Chemistry, Vol. 14, No. 3, pp. 375-382.

Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, E.M. Michalenko, 1991, "Handbook of Environmental Degradation Rates," Lewis Publishers, Chelsea, MI.

U.S. Dept. of Energy, 1999a, "1998 Integrated Site Environmental Report," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, Ohio.

U.S. Dept. of Energy, 1999b, "Integrated Environmental Monitoring Plan, Revision 1," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, Ohio.

U.S. Dept. of Energy, 1996, "Record of Decision for Remedial Actions at Operable Unit 5", Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1995, "Feasibility Study Report for Operable Unit 5," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

FIGURE A-1. SELECTION PROCESS USED FOR FRL CONSTITUENTS

50 FRLs Based on Operable Unit 5 Record of Decision

50 FRL constituents are categorized using the criteria below:

Constituent is categorized as ">", "<", "MP", or "N" if it has:

">"
- At least one FRL exceedance in the aquifer[a]
- Been analyzed using a method detection above the FRL value
- Been predicted to have the ability to migrate to the aquifer and cause an unacceptable risk[b]

"<"
- No FRL exceedance in the aquifer[a]
- Not been sampled in the aquifer but has been predicted to not have the ability to migrate to aquifer and cause an unacceptable risk
- Been analyzed using a method detection limit above FRL value and predicted to not have the ability to migrate to the aquifer and cause an unacceptable risk[b]
- Been identified as a common laboratory contaminant with unconfirmed FRL exceedance

"MP"
- Been predicted to be able to migrate to the aquifer and cause an unacceptable risk; constituent is considered to be "mobile and persistent"

"N"
- Been predicted to be unable to migrate to the aquifer and cause an unacceptable risk; constituent is not considered to be "mobile and persistent"

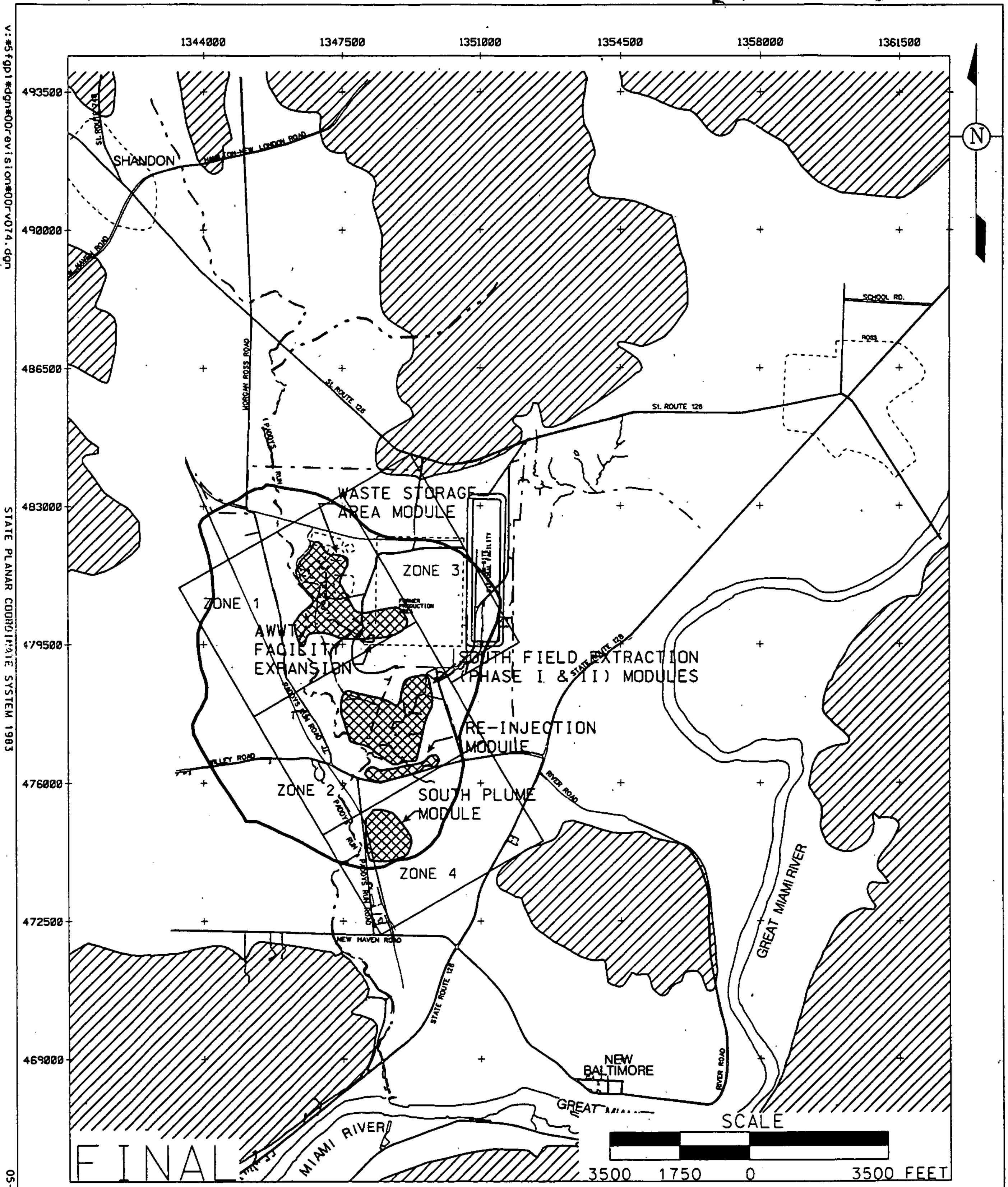
Zone	>MP[c]	<N	<MP	<N	Total
0	7	14	5	23	49
1	6	16	6	21	49
2	5	13	7	24	49
3	4	14	8	23	49
4	6	18	6	19	49

[a]FRL exceedances are based on data with a validation qualifier of - or J for data from 1988 through 1995 and - , J, or NV for data from 1996 through 1999.

[b]There were a few detection limits above the FRL for zinc. These were not considered in the evaluation because they did not reoccur.

[c]>MP represents a short list of nine (the shaded constituents on Table A-2) indicator constituents that will be monitored more frequently because they have FRL exceedances and are "mobile and persistent."

000276

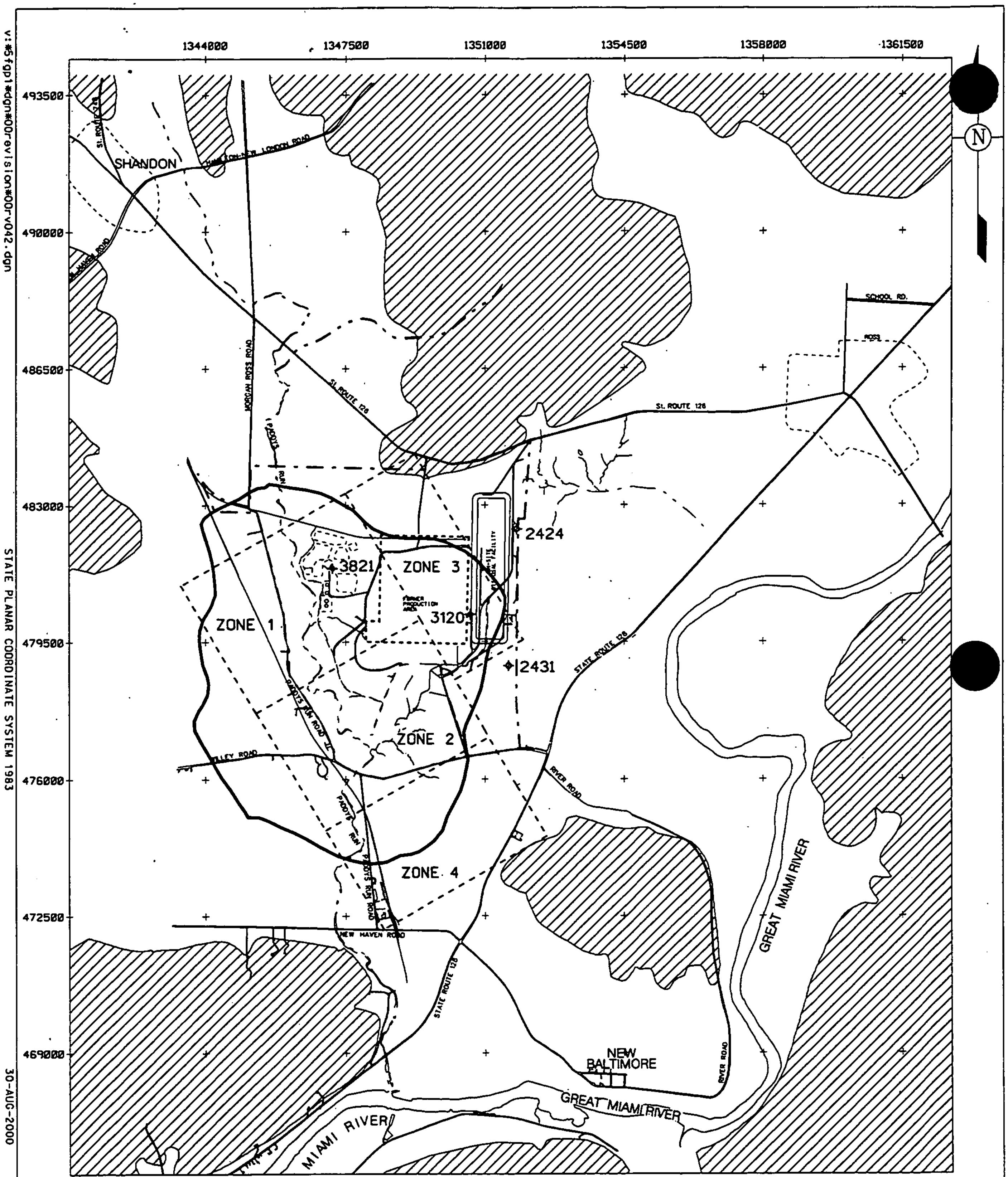


LEGEND:

- FEMP BOUNDARY
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS
- GEOGRAPHIC AREAS WITHIN WHICH EXTRACTION AND/OR RE-INJECTION WELLS ARE PLANNED

ZONE 0 CONSISTS OF ALL AREAS OUTSIDE ZONES 1, 2, 3, AND 4.

FIGURE A-2. GROUNDWATER AQUIFER ZONES AND AQUIFER RESTORATION FOOTPRINT



LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT[HING] OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

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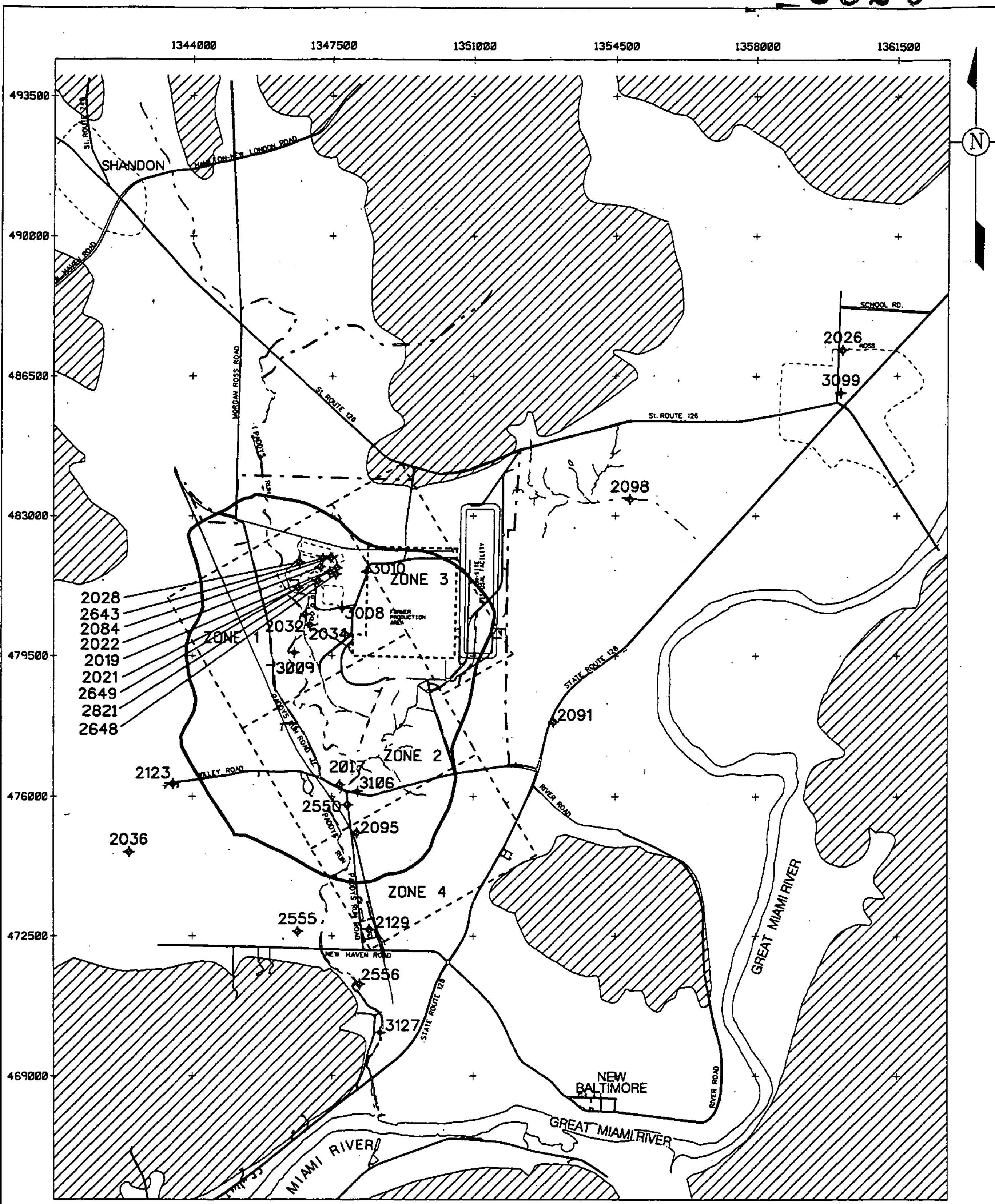
FINAL

FIGURE A-3. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR FLUORIDE



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STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000

LEGEND:

- FEMP BOUNDARY
- 3120 MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

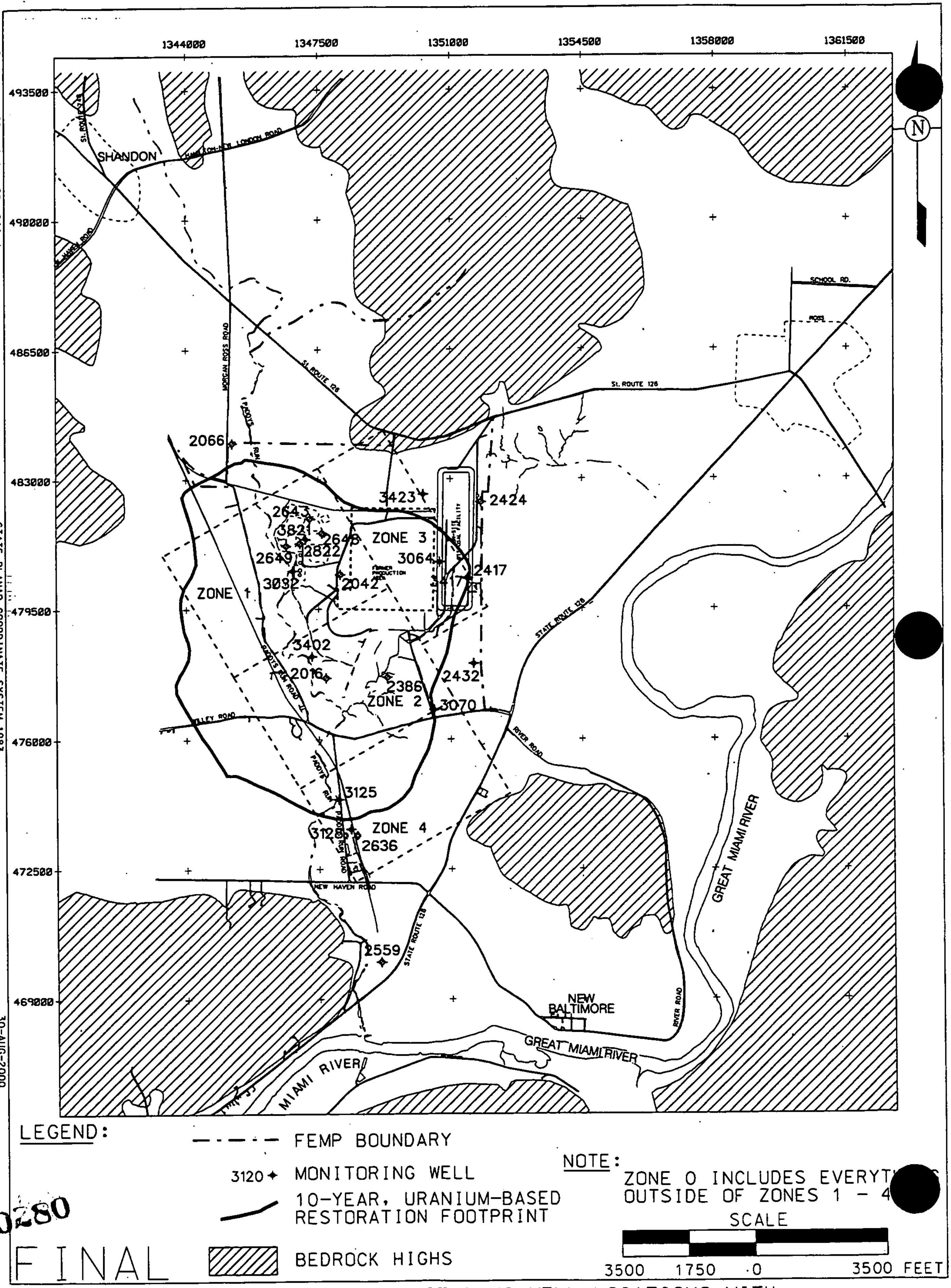
NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4.

SCALE

3500 1750 0 3500 FEET

FINAL

FIGURE A-4. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR NITRATE v:\$fgpl\$dgn\$0Orevision\$0Orv044.dgn



STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000

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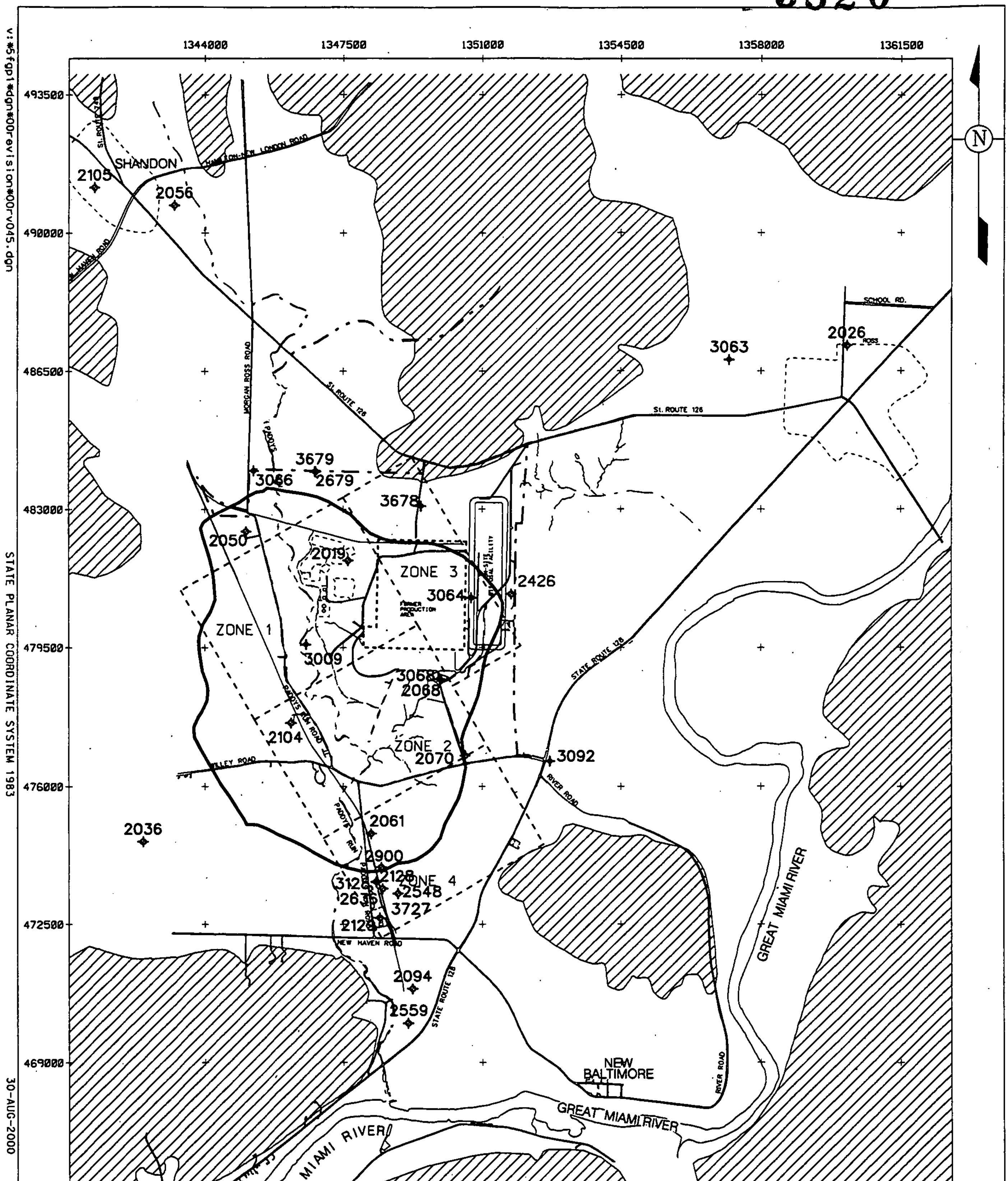
FINAL

FIGURE A-5. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR ANTIMONY



LEGEND:

FEMP BOUNDARY

3120 MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

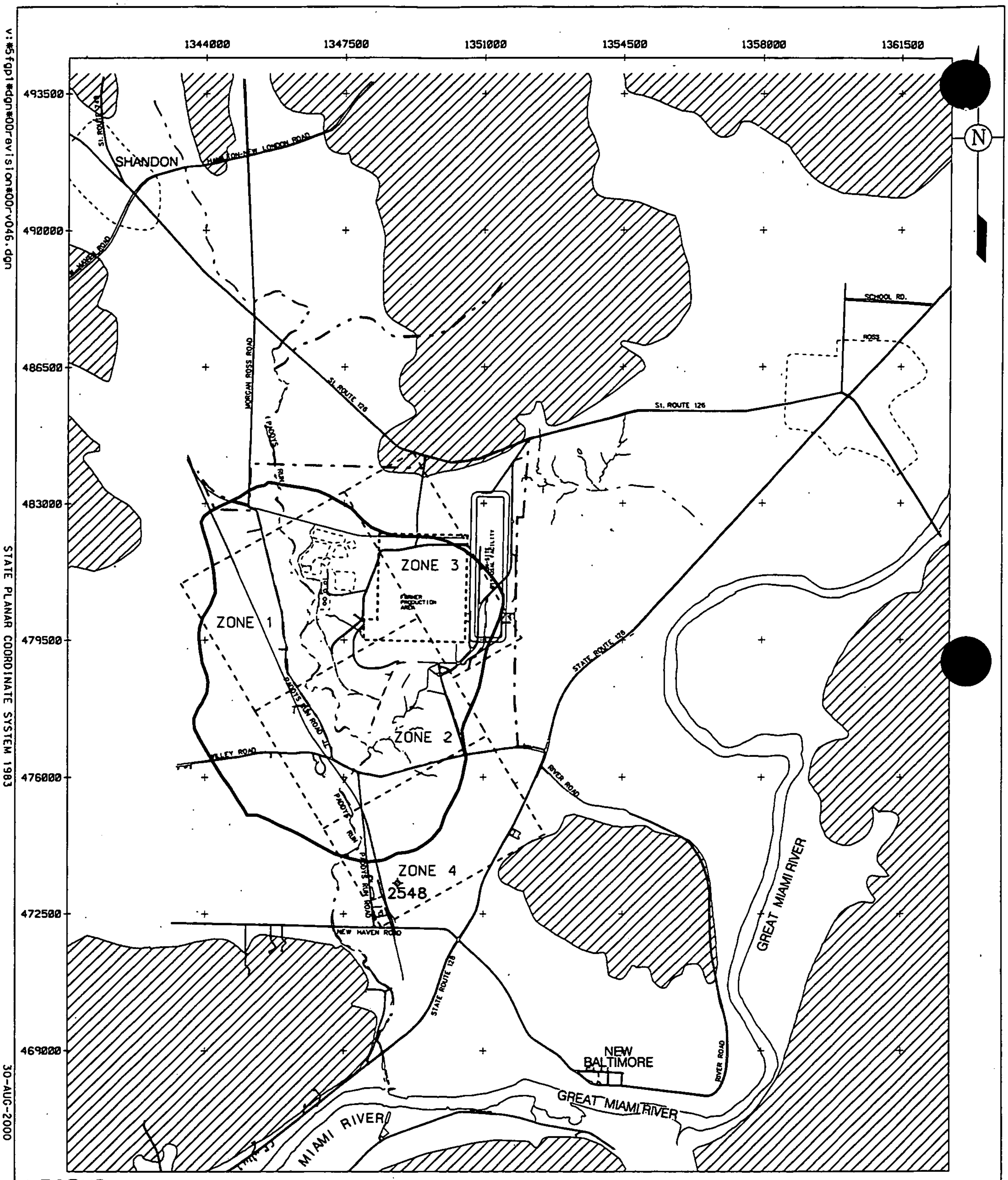
BEDROCK HIGHS

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE
3500 1750 0 3500 FEET

FINAL

FIGURE A-6. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR ARSENIC



LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT[illegible] OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

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FINAL

FIGURE A-7. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BARIUM

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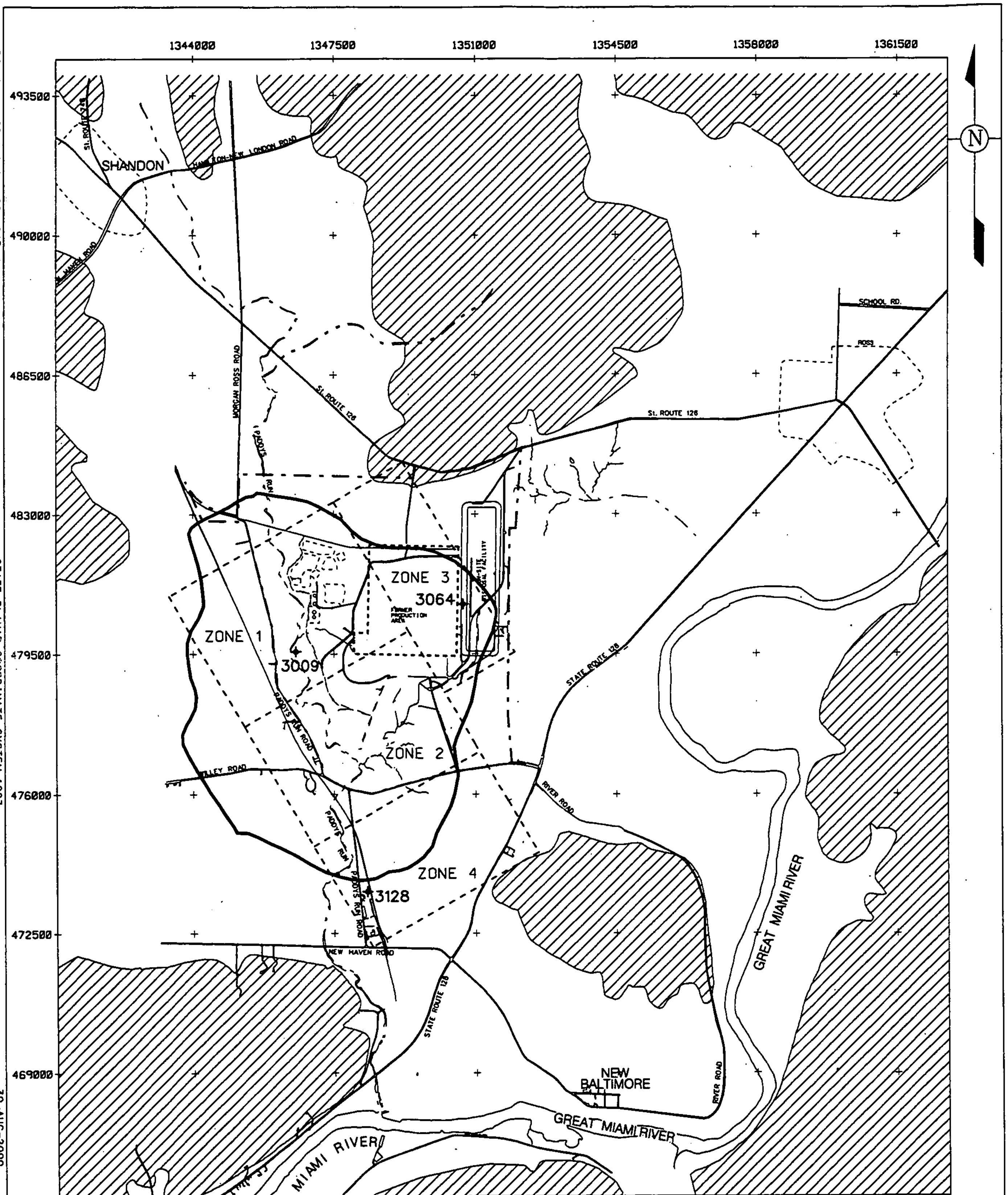


LEGEND:

- FEMP BOUNDARY
- 3120 MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

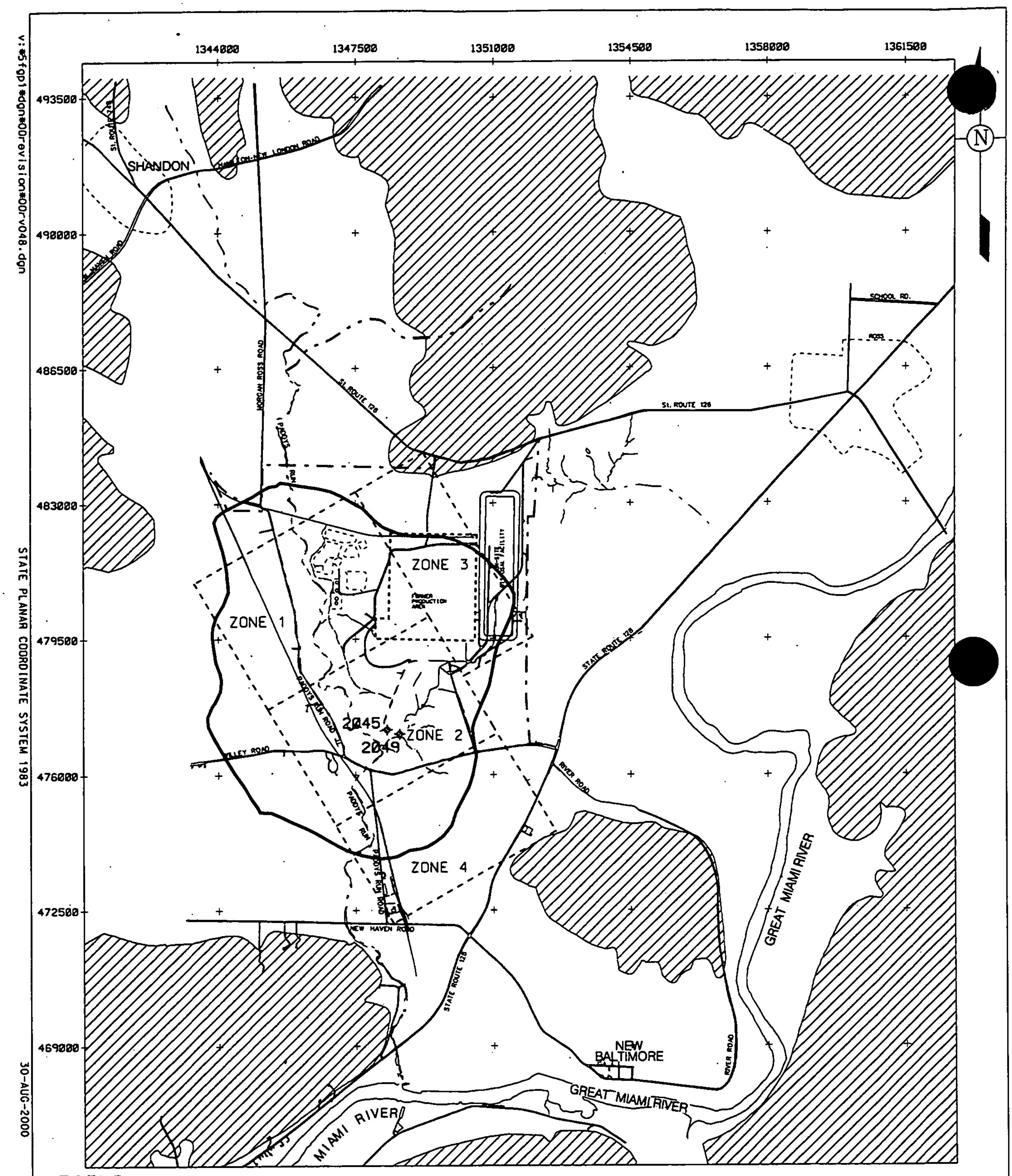
NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

FINAL

FIGURE A-8. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BERYLLIUM



LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

000284

FINAL

FIGURE A-9. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BORON

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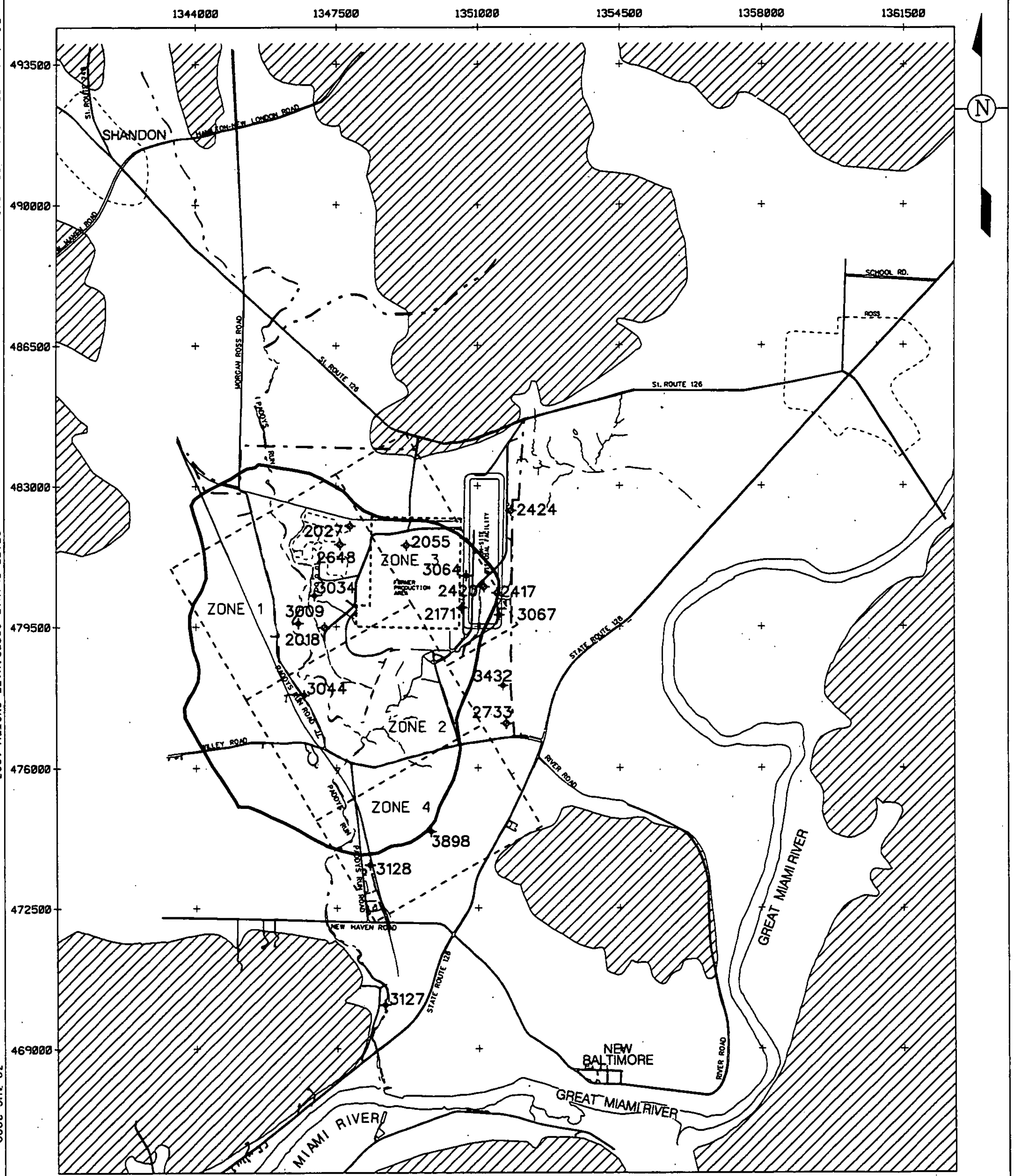


STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000

LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

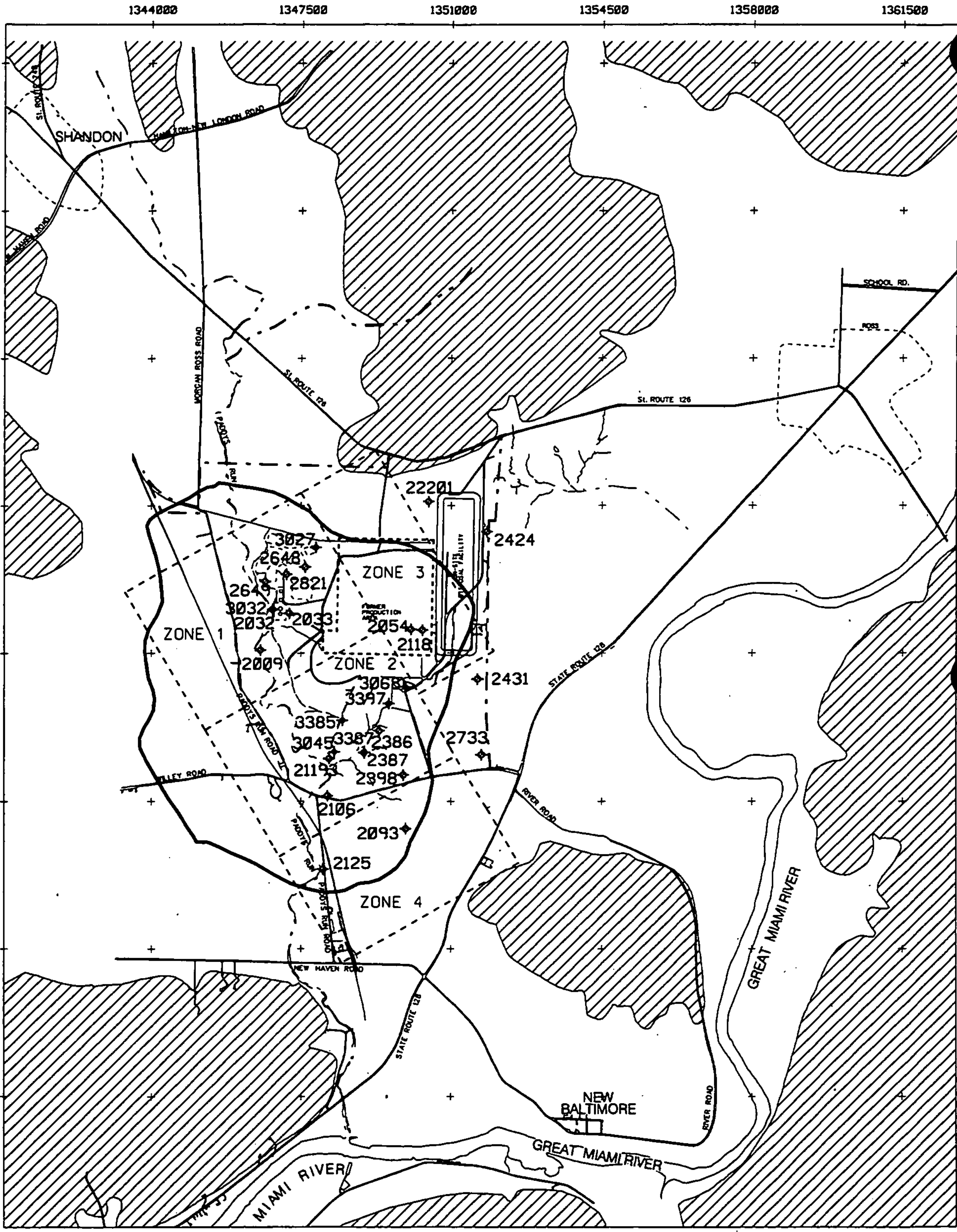
3500 1750 0 3500 FEET

FINAL

FIGURE A-10. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR CADMIUM

STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000



LEGEND:

- FEMP BOUNDARY
- 3120 ✦ MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT[HING] OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

000286

FINAL

FIGURE A-11. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR CHROMIUM

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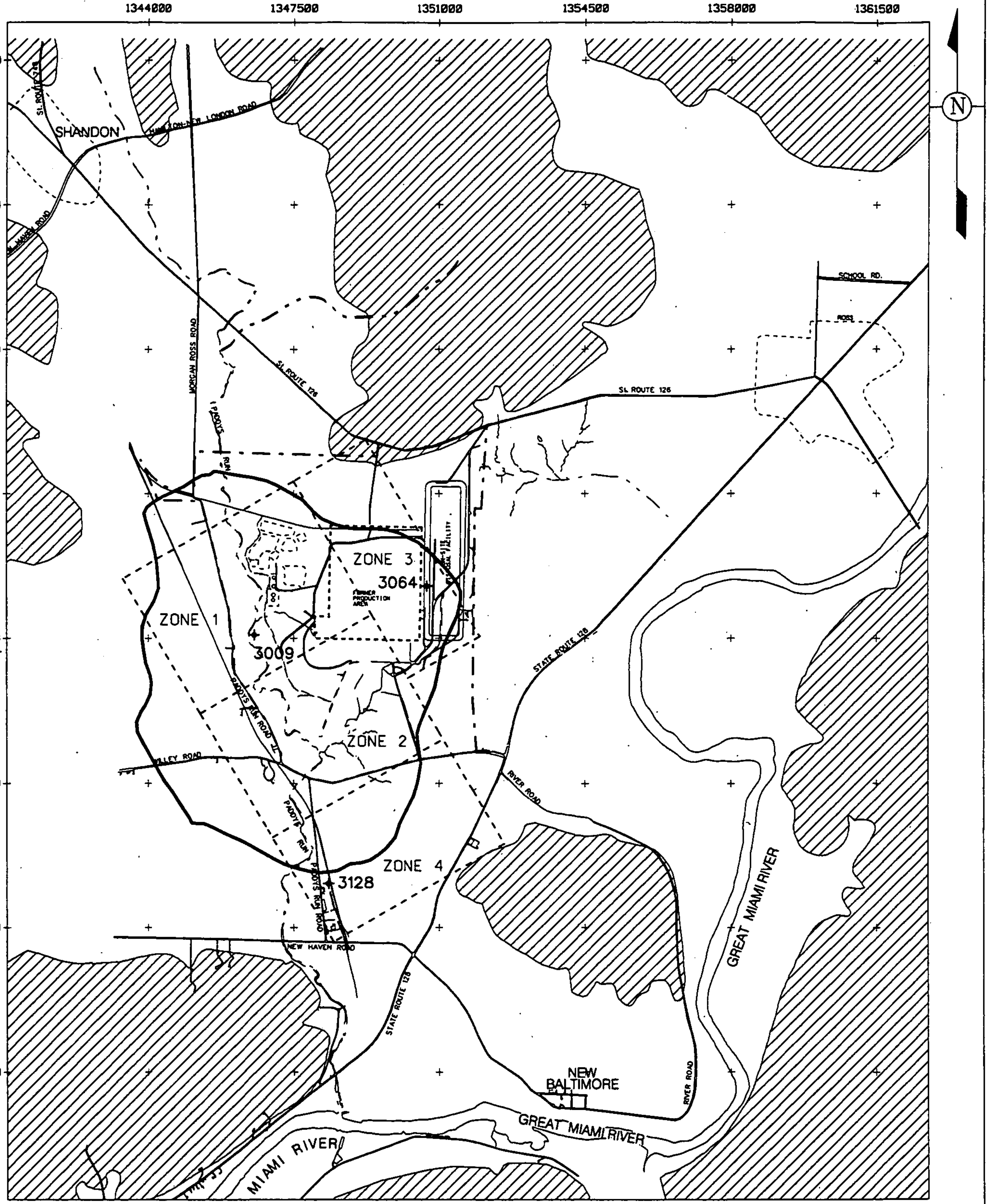


STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000

LEGEND:

- FEMP BOUNDARY
- 3120 ✦ MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

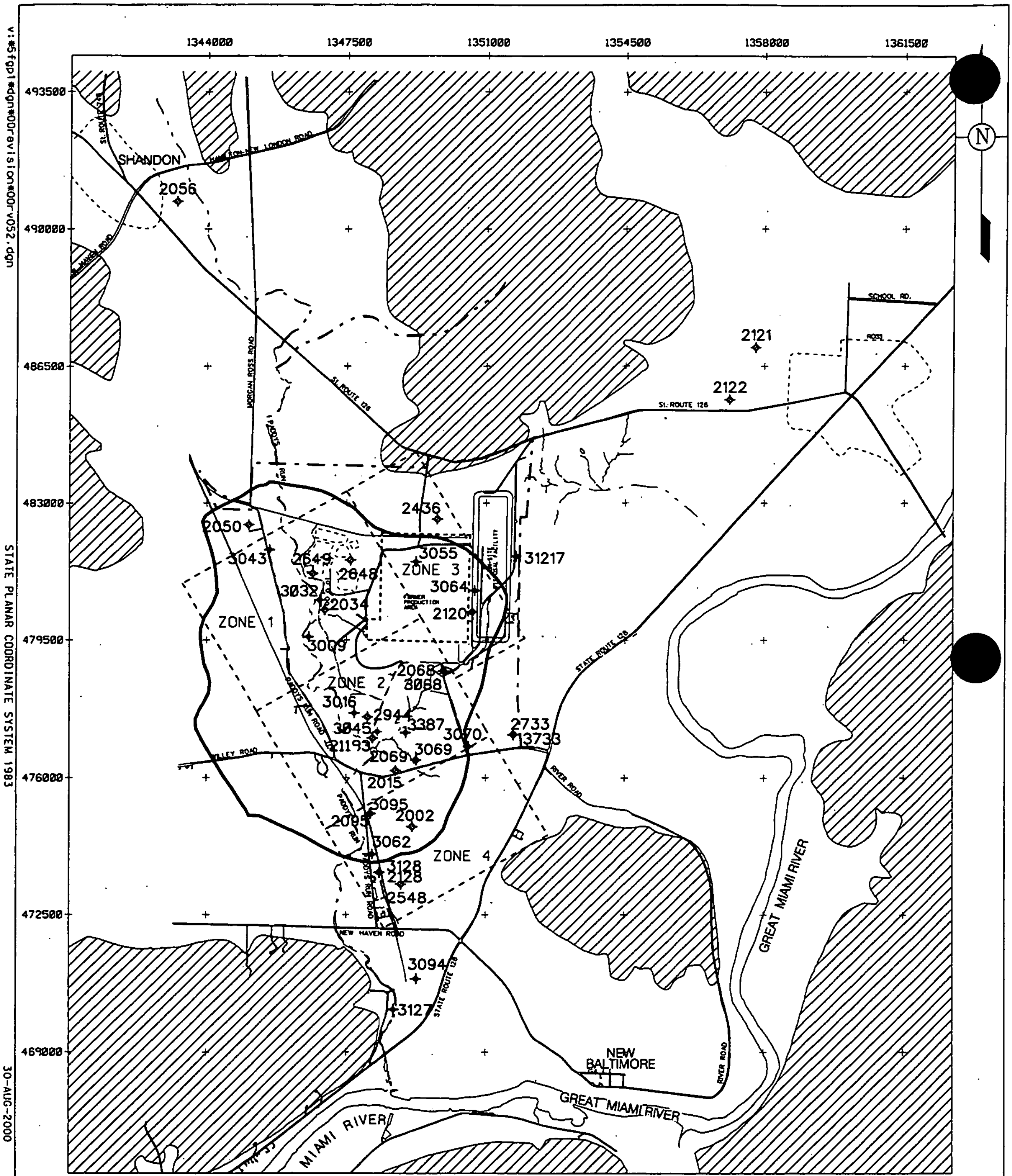
SCALE

3500 1750 0 3500 FEET

FINAL

000287

FIGURE A-12. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR COBALT



LEGEND:

- FEMP BOUNDARY
- 3120 + MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT
OUTSIDE OF ZONES 1 - 4

SCALE

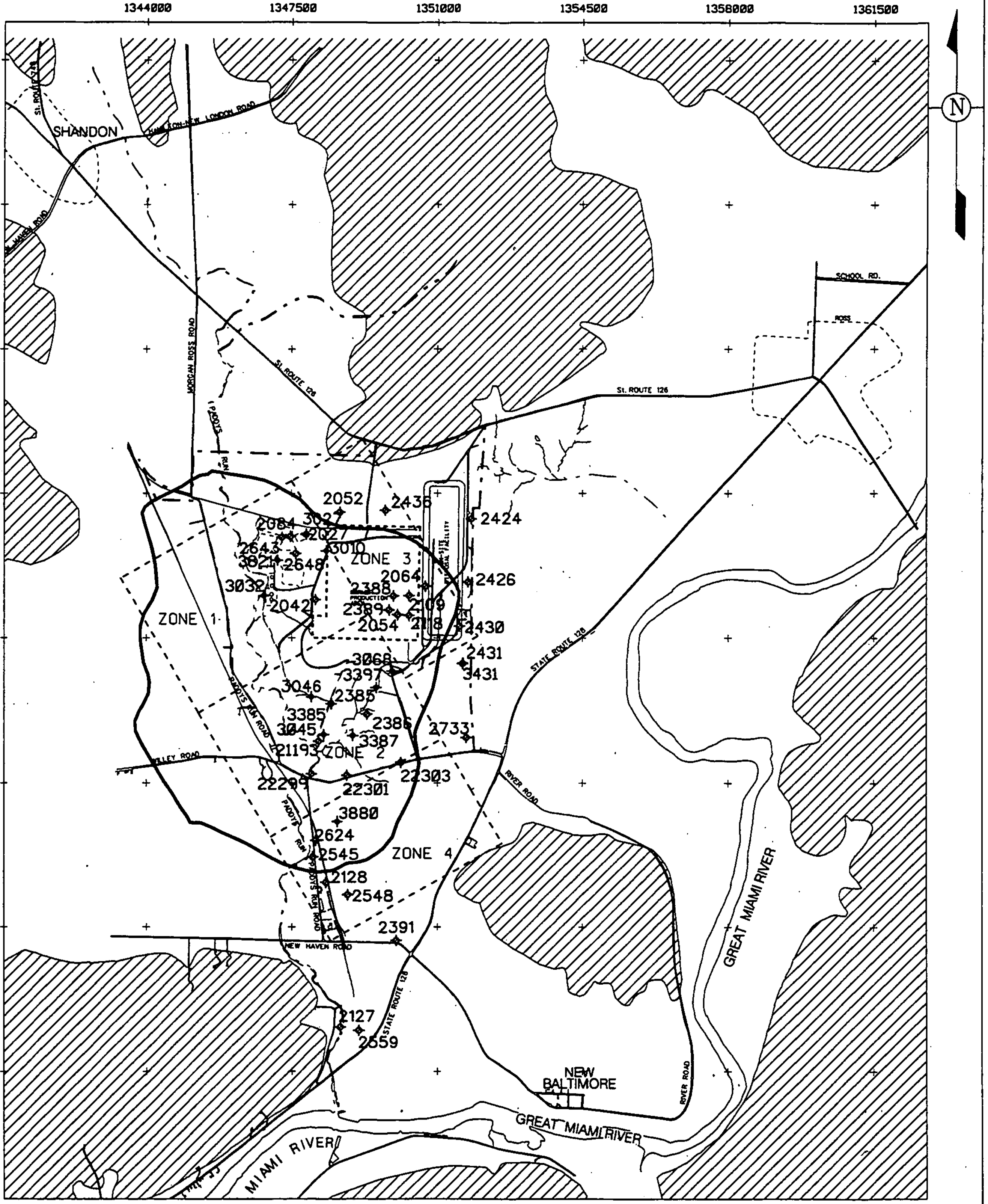
3500 1750 0 3500 FEET

000288

FINAL

FIGURE A-13. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR LEAD

v:\5fgp1\dgn\00revision\00rv053.dgn



STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000

LEGEND:

FEMP BOUNDARY

3120 MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

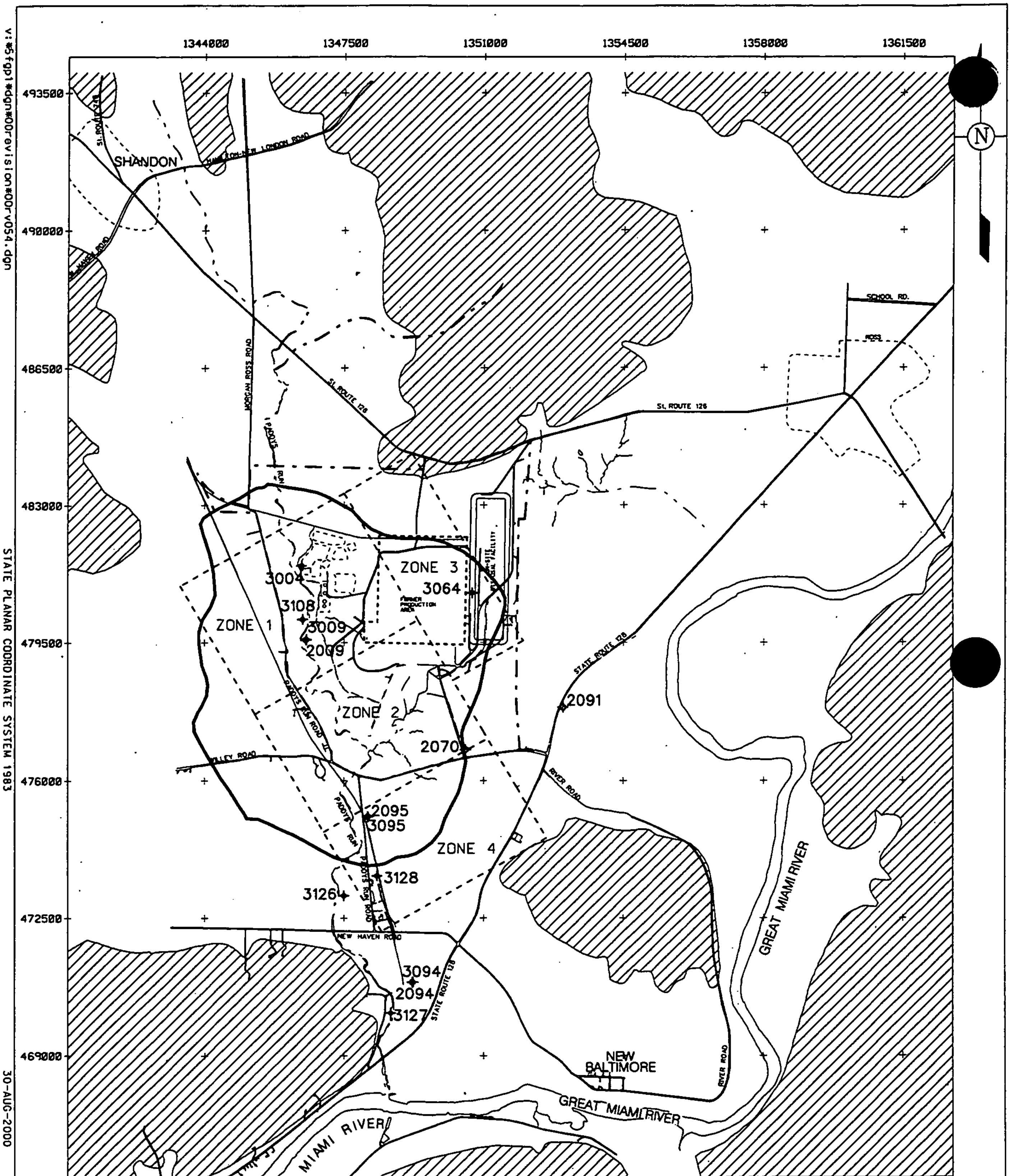
SCALE

3500 1750 0 3500 FEET

FINAL

000089

FIGURE A-14. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR MANGANESE



LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

000290

FINAL

FIGURE A-15. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR MERCURY

3320

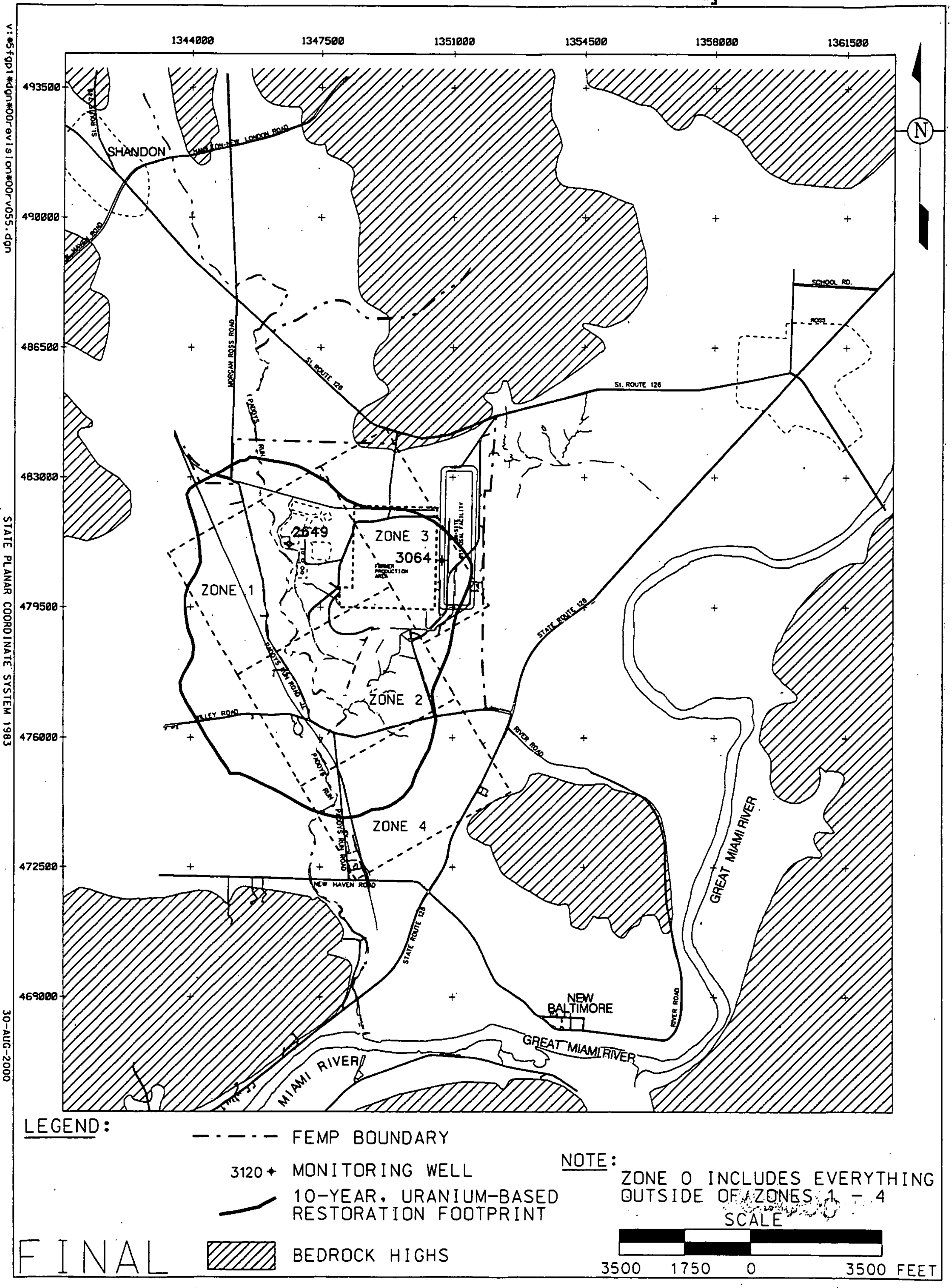
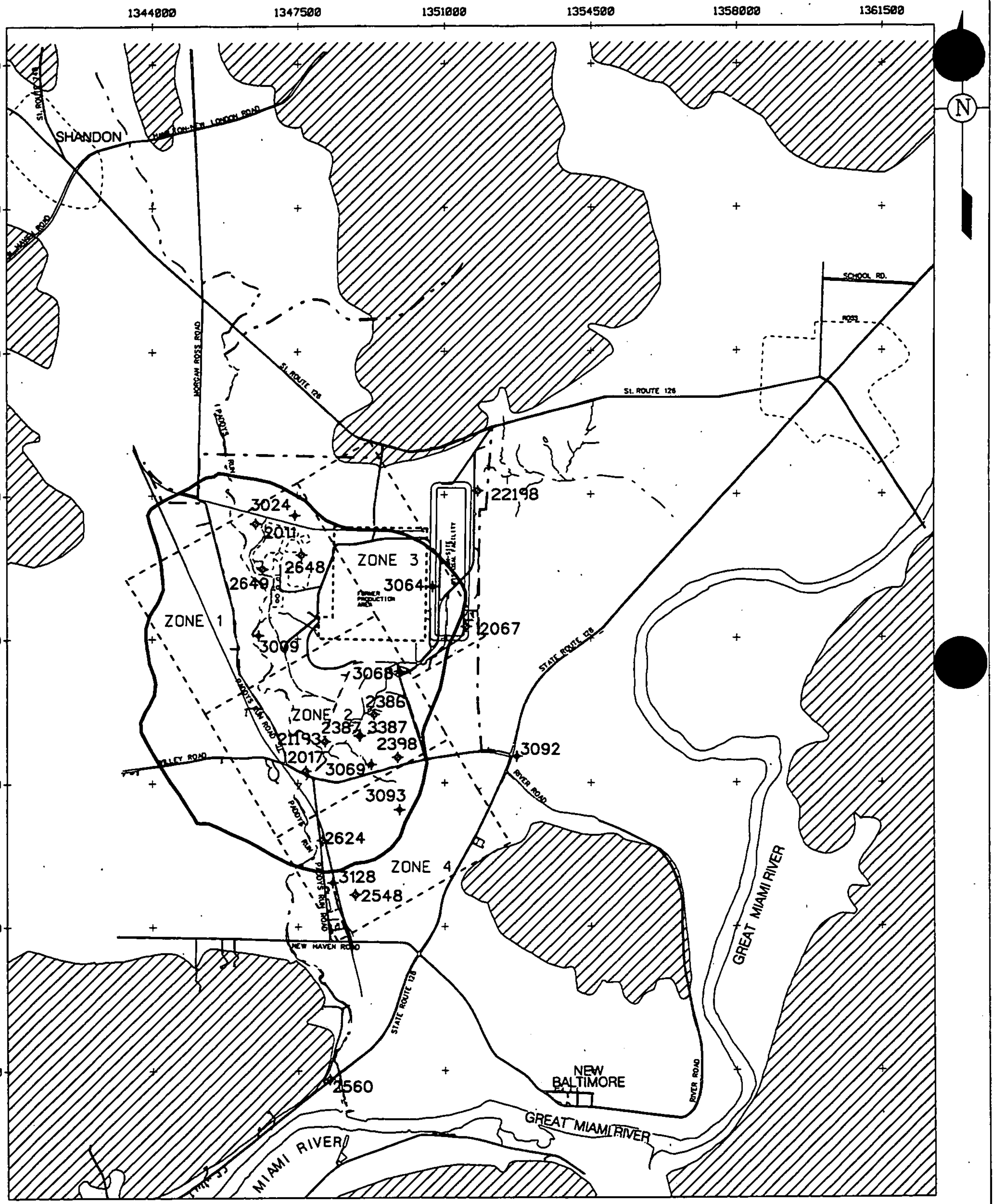


FIGURE A-16. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR MOLYBDENUM

000291



LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT[illegible] OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

v:\5fgp1\dgn\00revision\00rv056.dgn

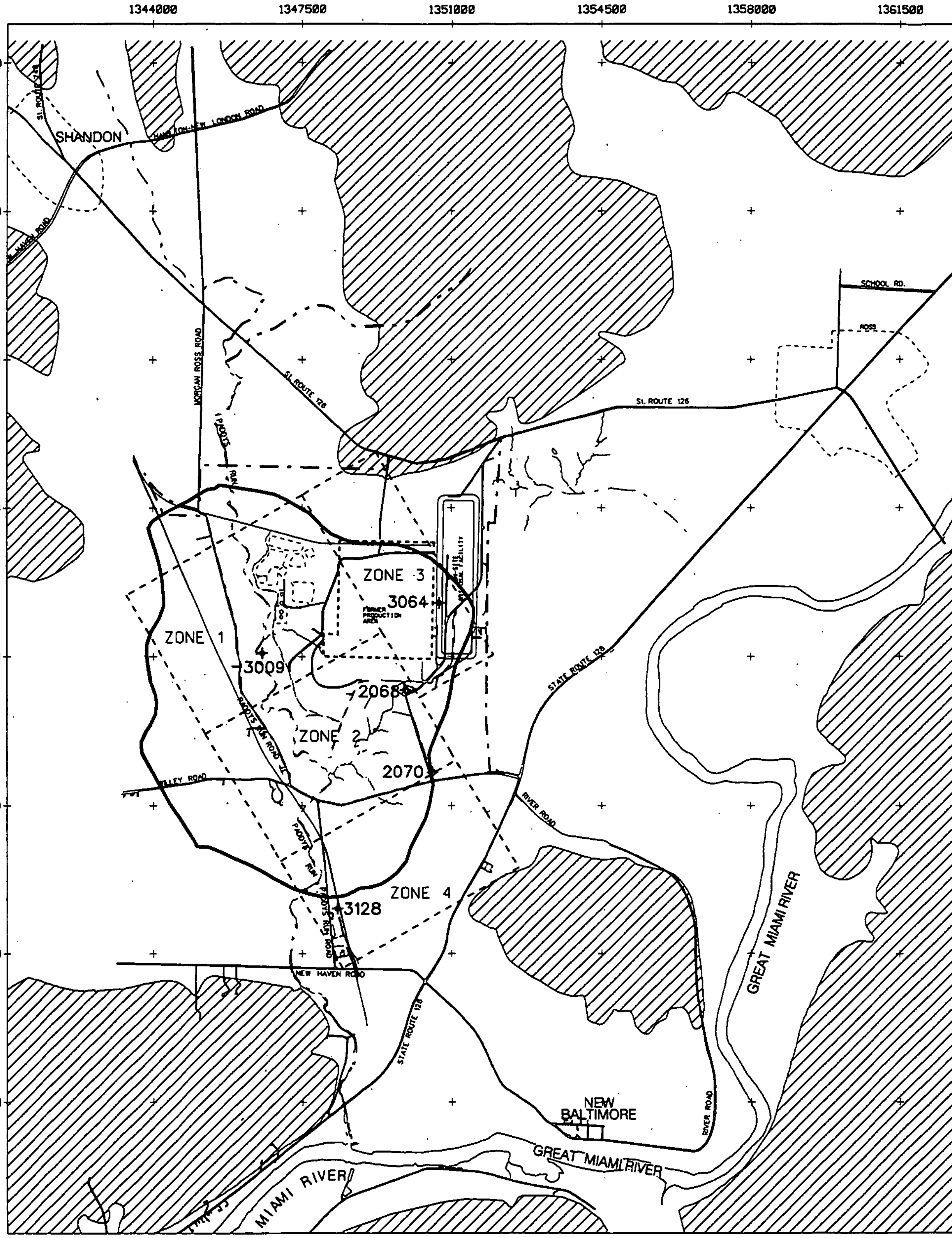
STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000

000292

FINAL

FIGURE A-17. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR NICKEL



v:\5fgp1\dgn\00revision\00rv057.dgn

STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000

LEGEND:

- FEMP BOUNDARY
- 3120 ✦ MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1-4

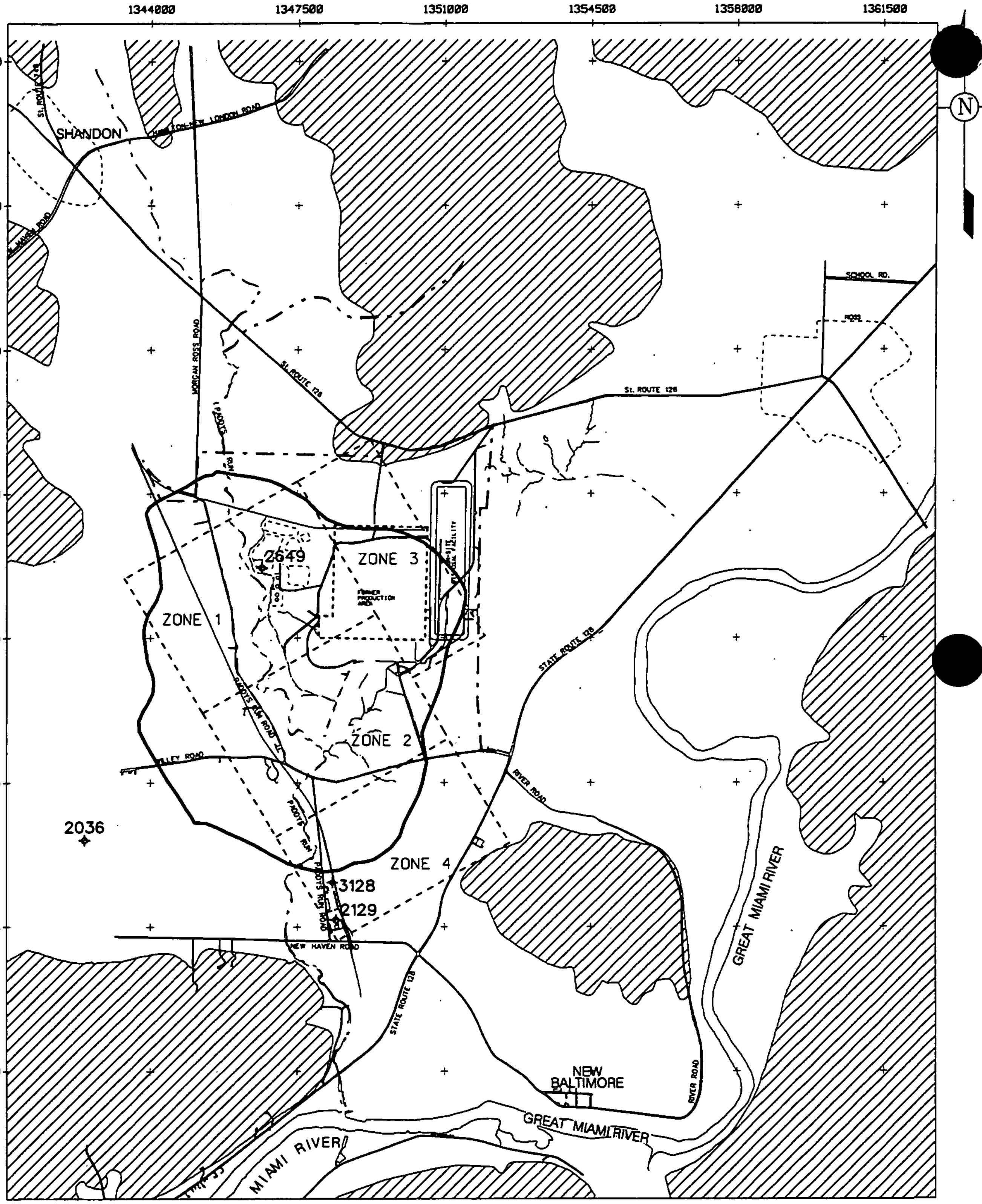
SCALE

3500 1750 0 3500 FEET

FINAL

FIGURE A-18. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR SELENIUM

v:\5fgp1\dgn\00revision\00rv058.dgn



STATE PLANAR COORDINATE SYSTEM 1983

30-AUG-2000

LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT[HING] OUTSIDE OF ZONES 1 - 4

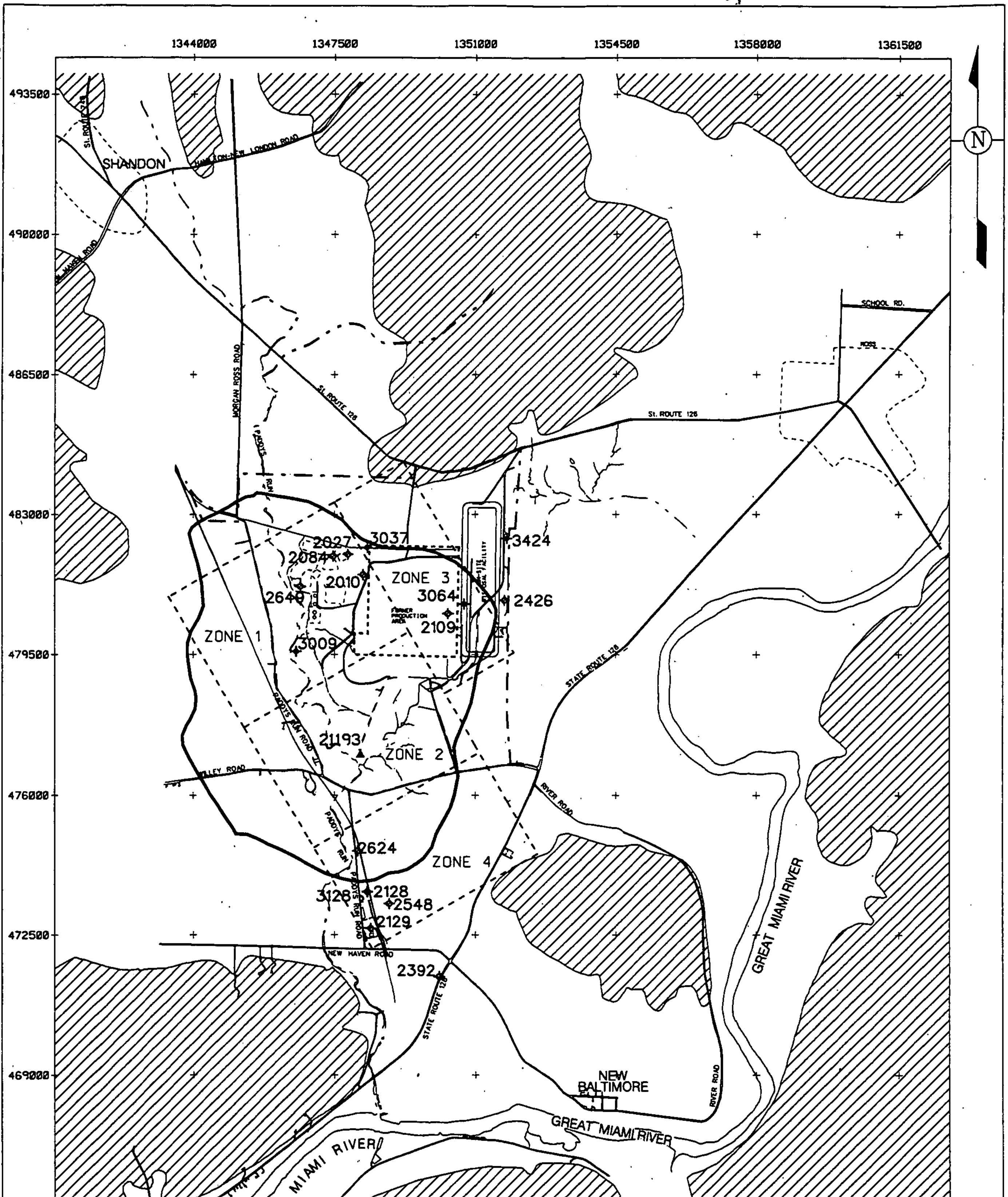
SCALE

3500 1750 0 3500 FEET

000291

FINAL

FIGURE A-19. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR SILVER



LEGEND:

- FEMP BOUNDARY
- 3120 MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

v:\5fgp1\dgn\0revision\0rv059.dgn

STATE PLANAR COORDINATE SYSTEM 1983

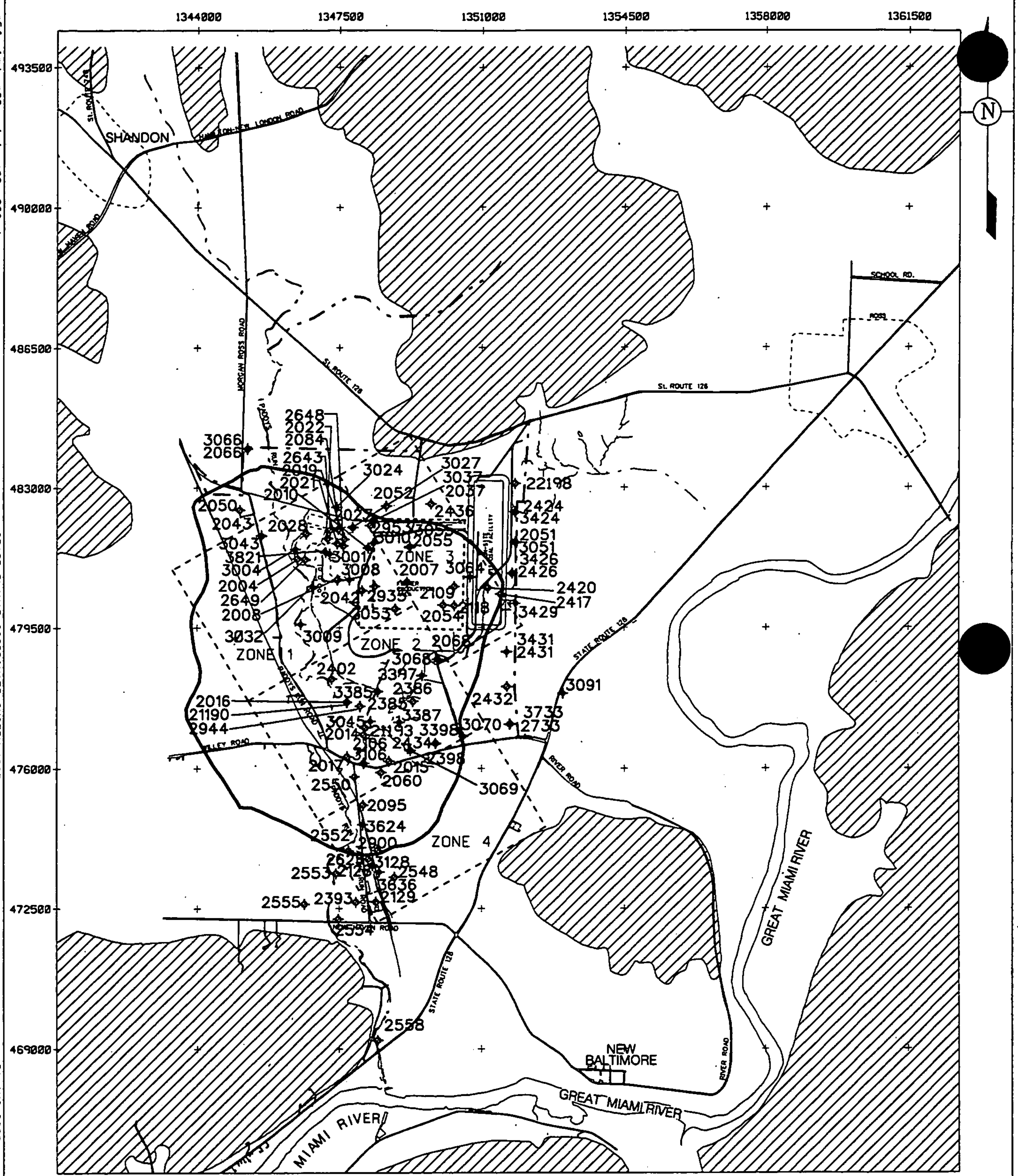
30-AUG-2000

FINAL

FIGURE A-20. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR VANADIUM v:#5fgp1#dgn#00revision#00rv060.dgn

STATE PLANAR COORDINATE SYSTEM 1983

31-AUG-2000



LEGEND:

— · — · — FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT[...] OUTSIDE OF ZONES 1 - 4

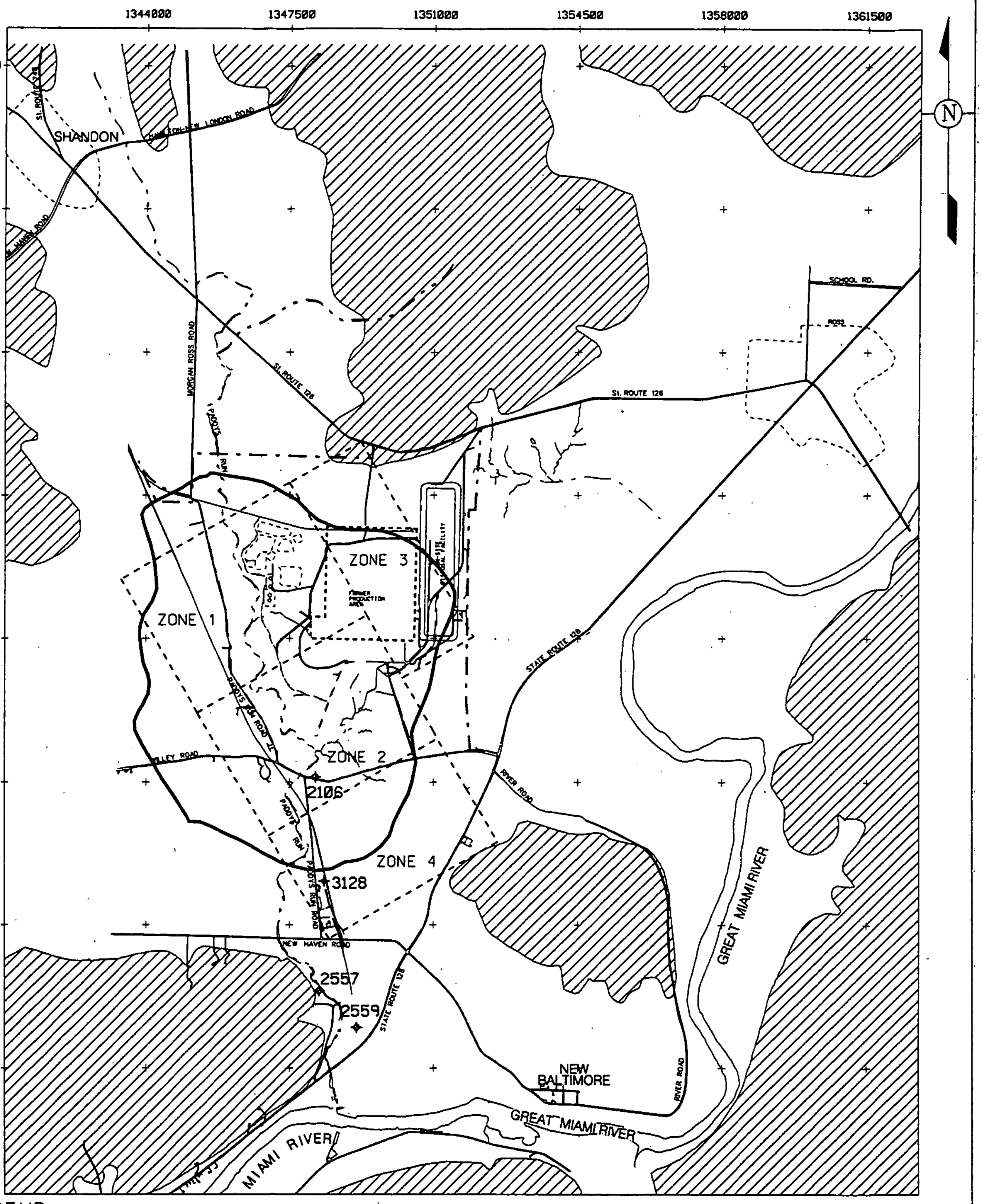
SCALE

3500 1750 0 3500 FEET

000296

FINAL

FIGURE A-21. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR ZINC



v:\5fgp1\dgn\00revision\00rv061.dgn

STATE PLANAR COORDINATE SYSTEM 1983

31-AUG-2000

LEGEND:

- FEMP BOUNDARY
- 3120 ✦ MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

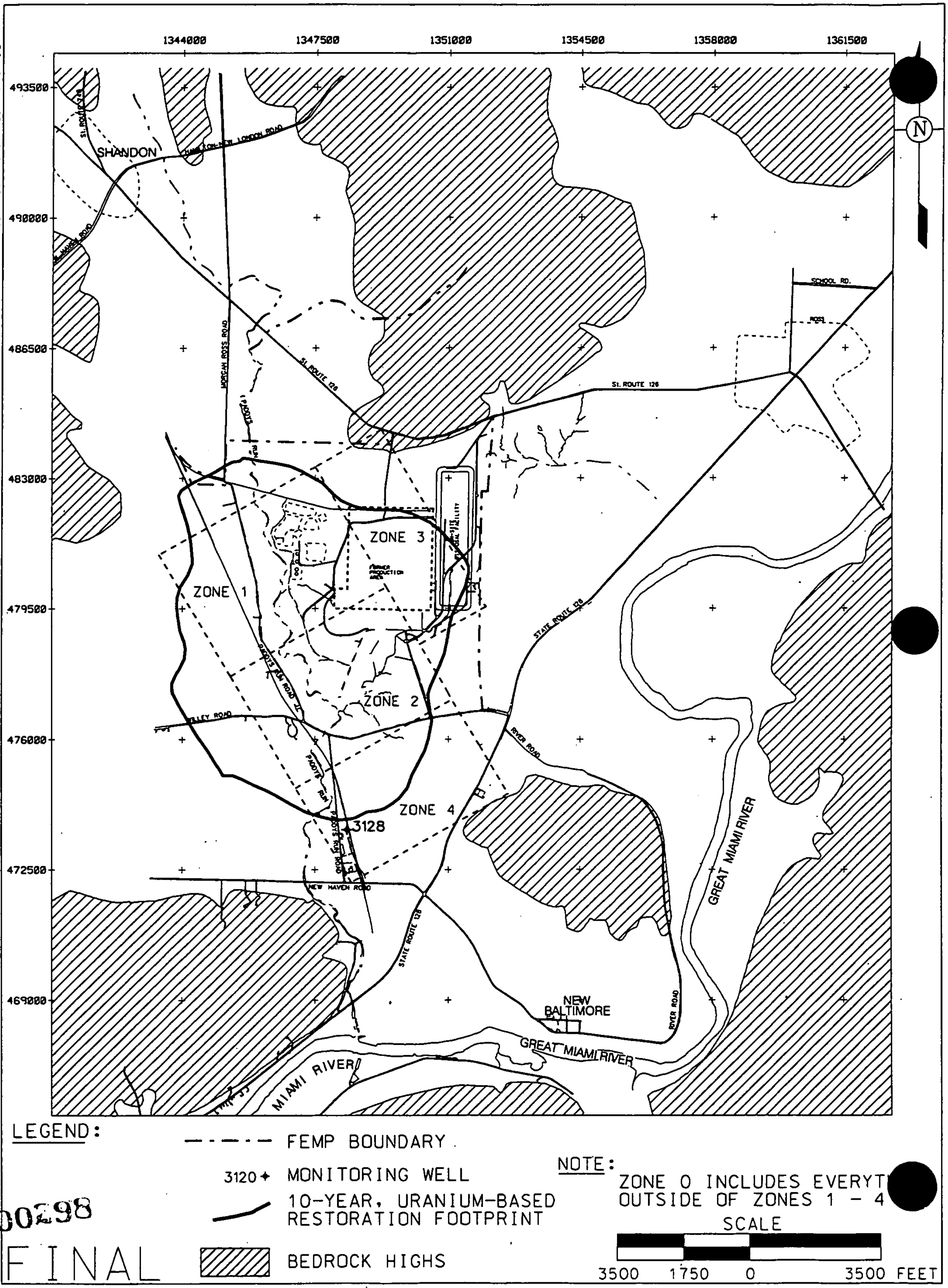
NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

FINAL

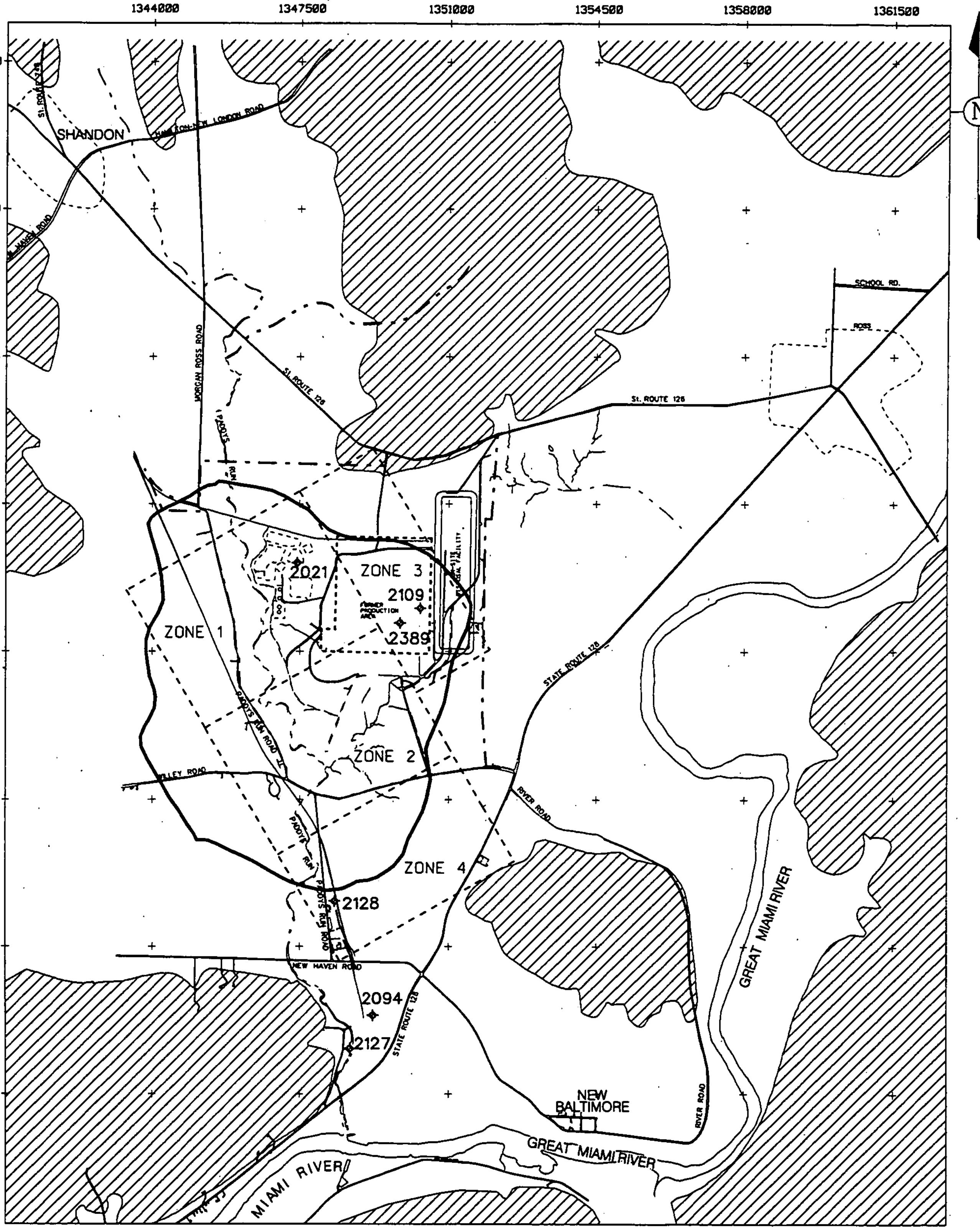
FIGURE A-22. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR NEPTUNIUM-237



000298

FINAL

FIGURE A-23. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR RADIUM-226 v:\5fap1\dgn\00revision\00rv063.dgn



STATE PLANAR COORDINATE SYSTEM 1983

31-AUG-2000

LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

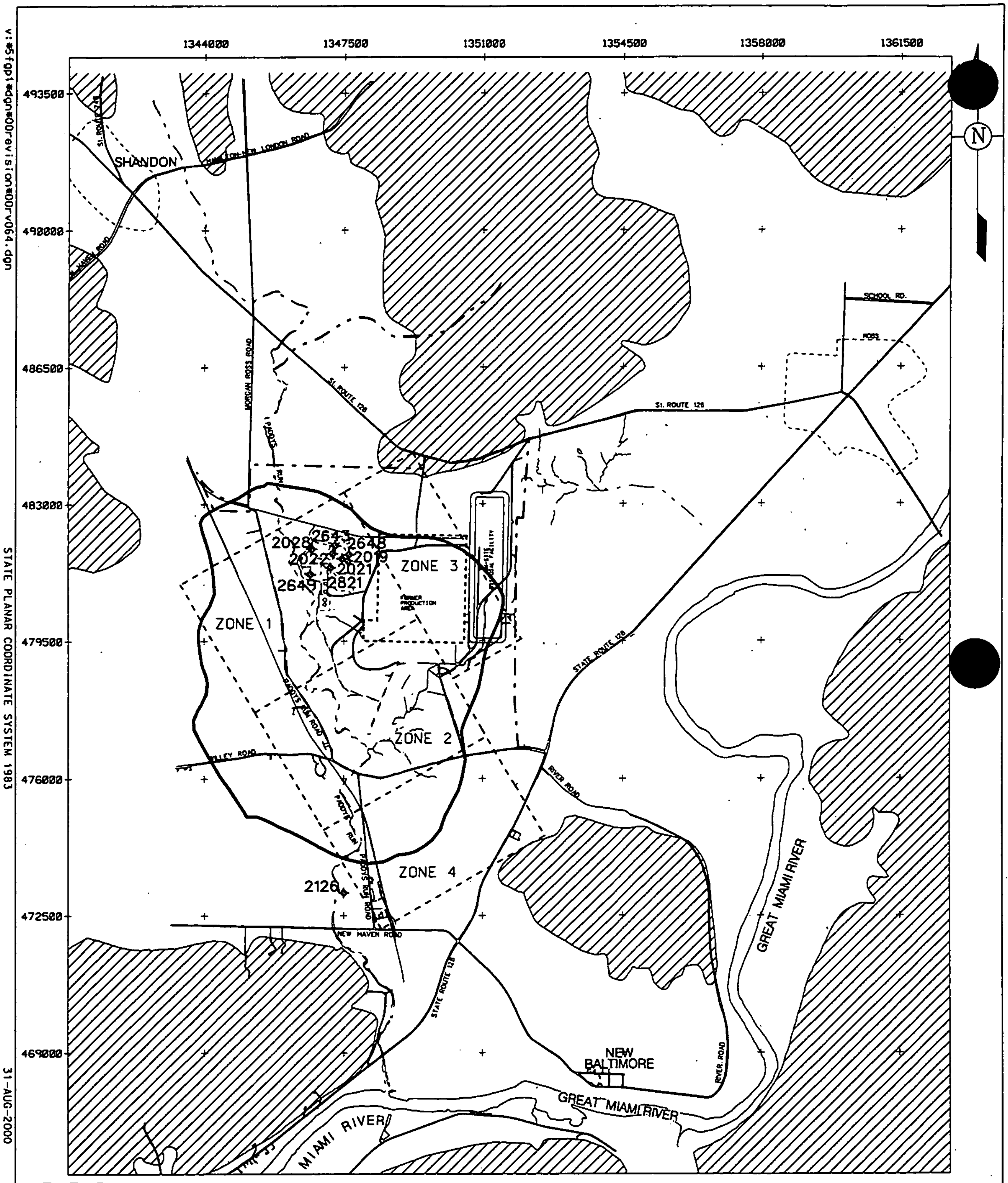
NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

FINAL

FIGURE A-24. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR STRONTIUM-90



LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT[HING] OUTSIDE OF ZONES 1 - 4

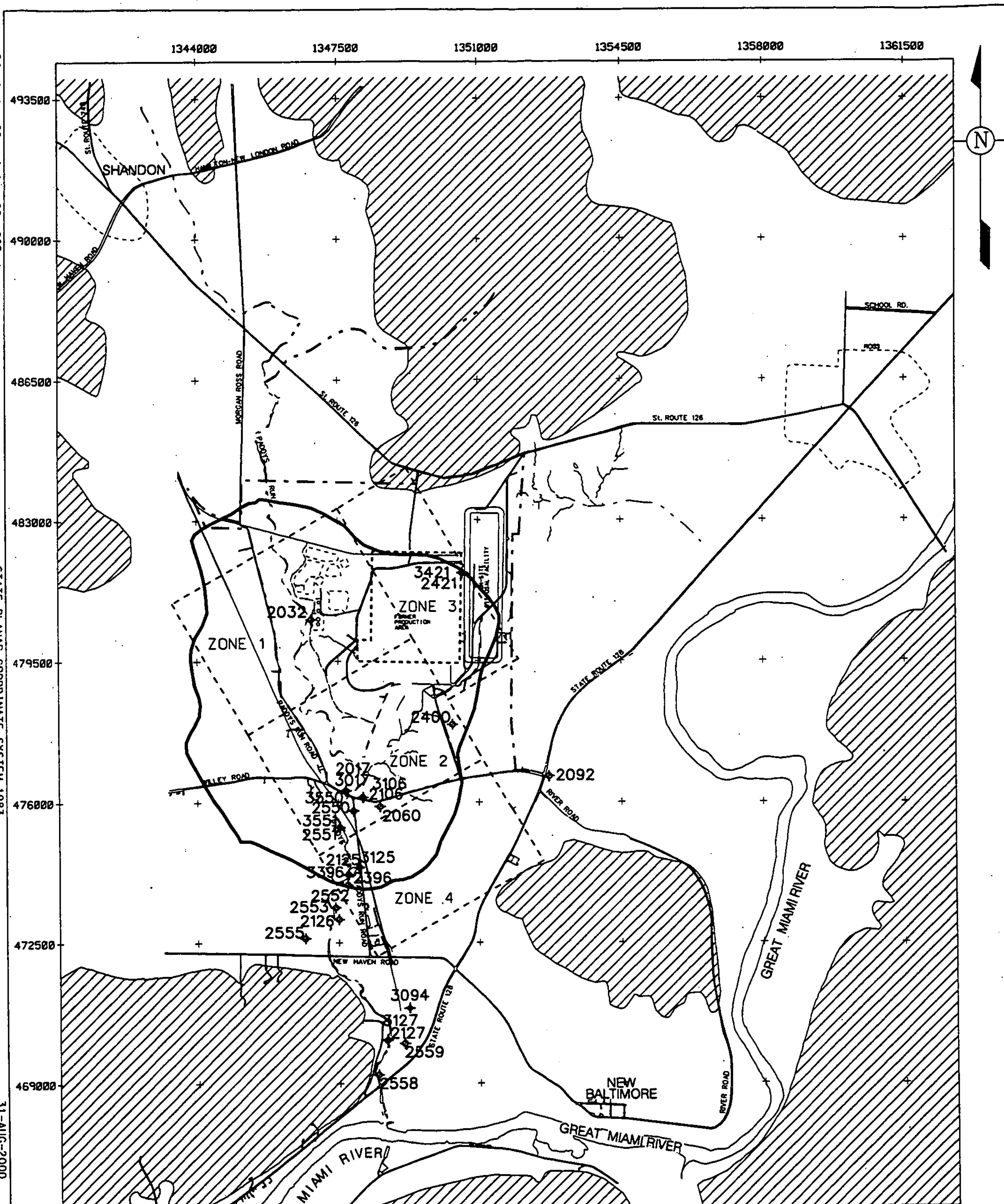
SCALE

3500 1750 0 3500 FEET

000300

FINAL

FIGURE A-25. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR TECHNETIUM-99



v:\5fgpl\dgn\00revision\00rv065.dgn

STATE PLANAR COORDINATE SYSTEM 1983

31-AUG-2000

LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

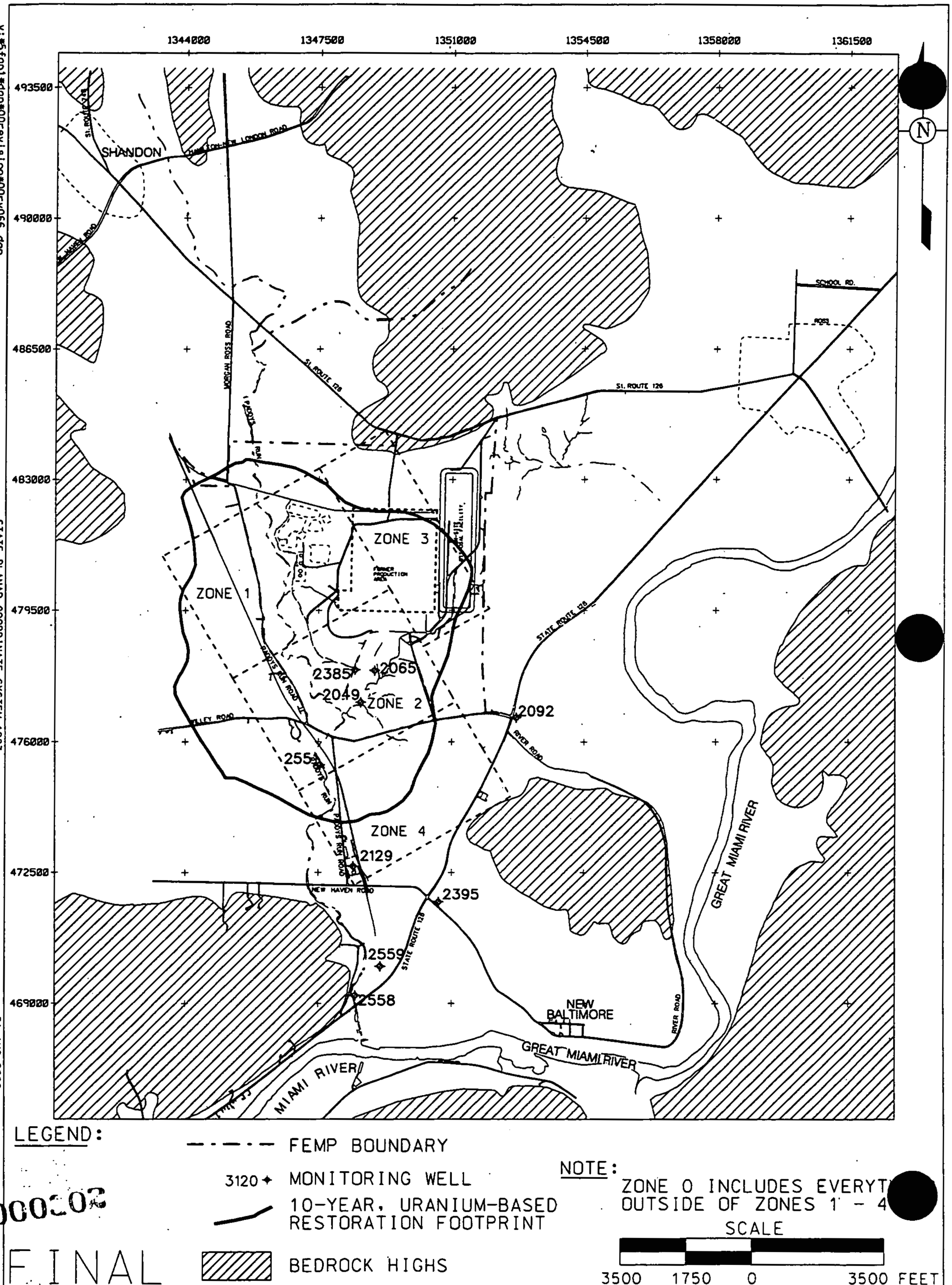
SCALE

3500 1750 0 3500 FEET

FINAL

FIGURE A-26. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR THORIUM-228

000301

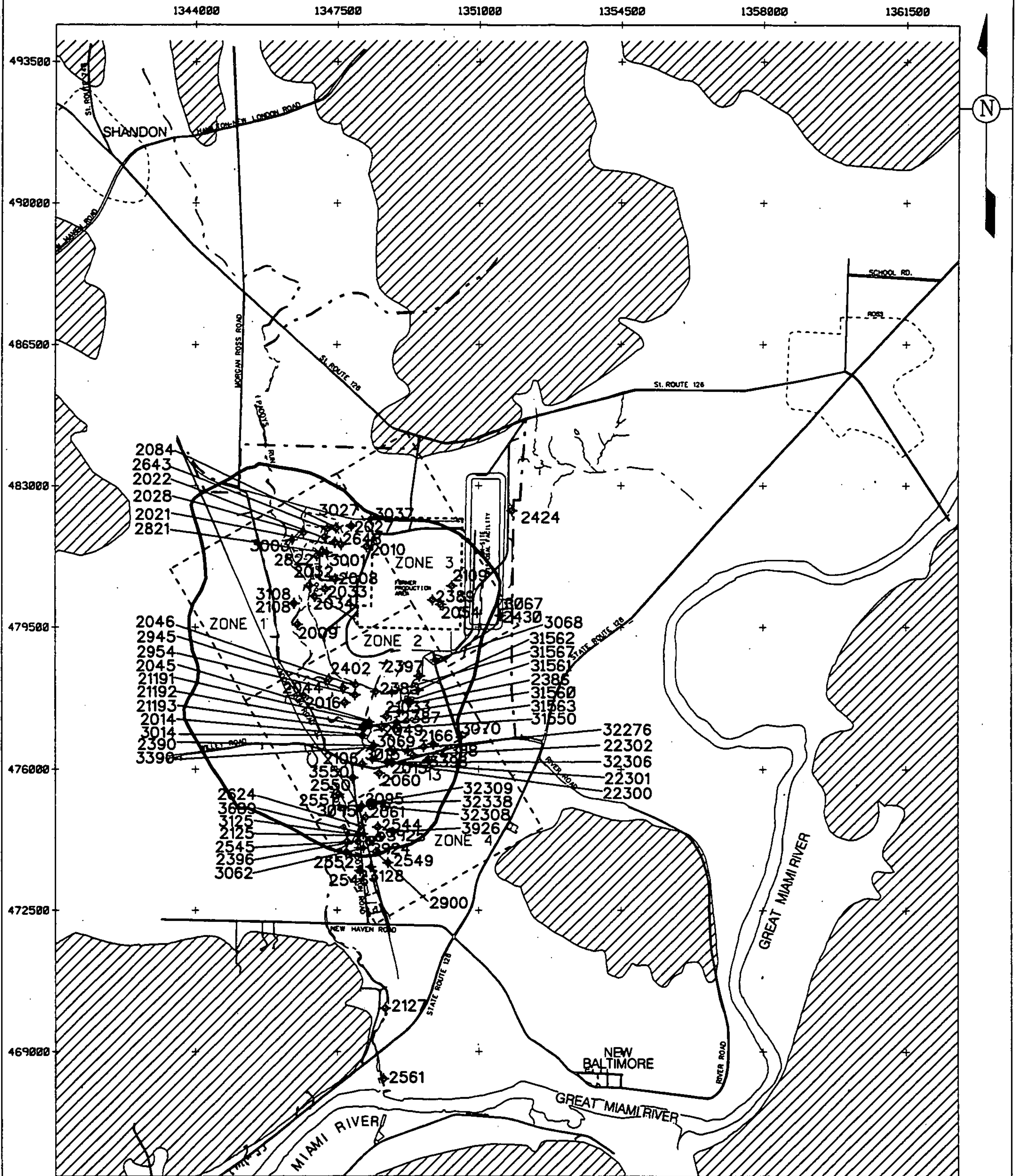


000203

FINAL

FIGURE A-27. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR THORIUM-232

-3320



STATE PLANAR COORDINATE SYSTEM 1983

31-AUG-2000

LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

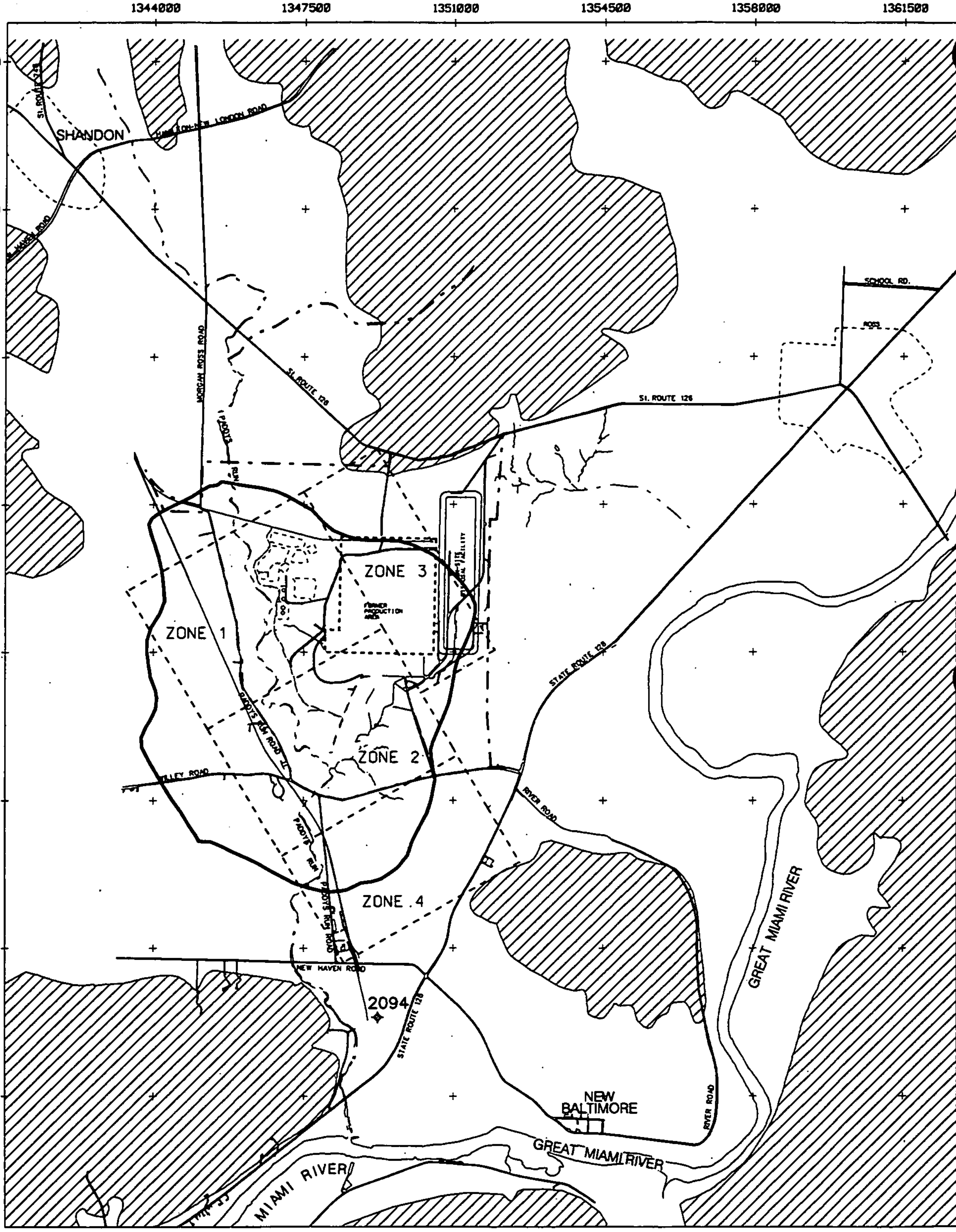
NOTE: ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

FINAL

FIGURE A-28. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR TOTAL URANIUM



LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT[HING] OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

v:#5fop1#dgn#00revision#00rv068.dgn

STATE PLANAR COORDINATE SYSTEM 1983

31-AUG-2000

000201

FINAL

FIGURE A-29. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BENZENE

v:\5fgp1\dgn\00revision\00rv069.dgn

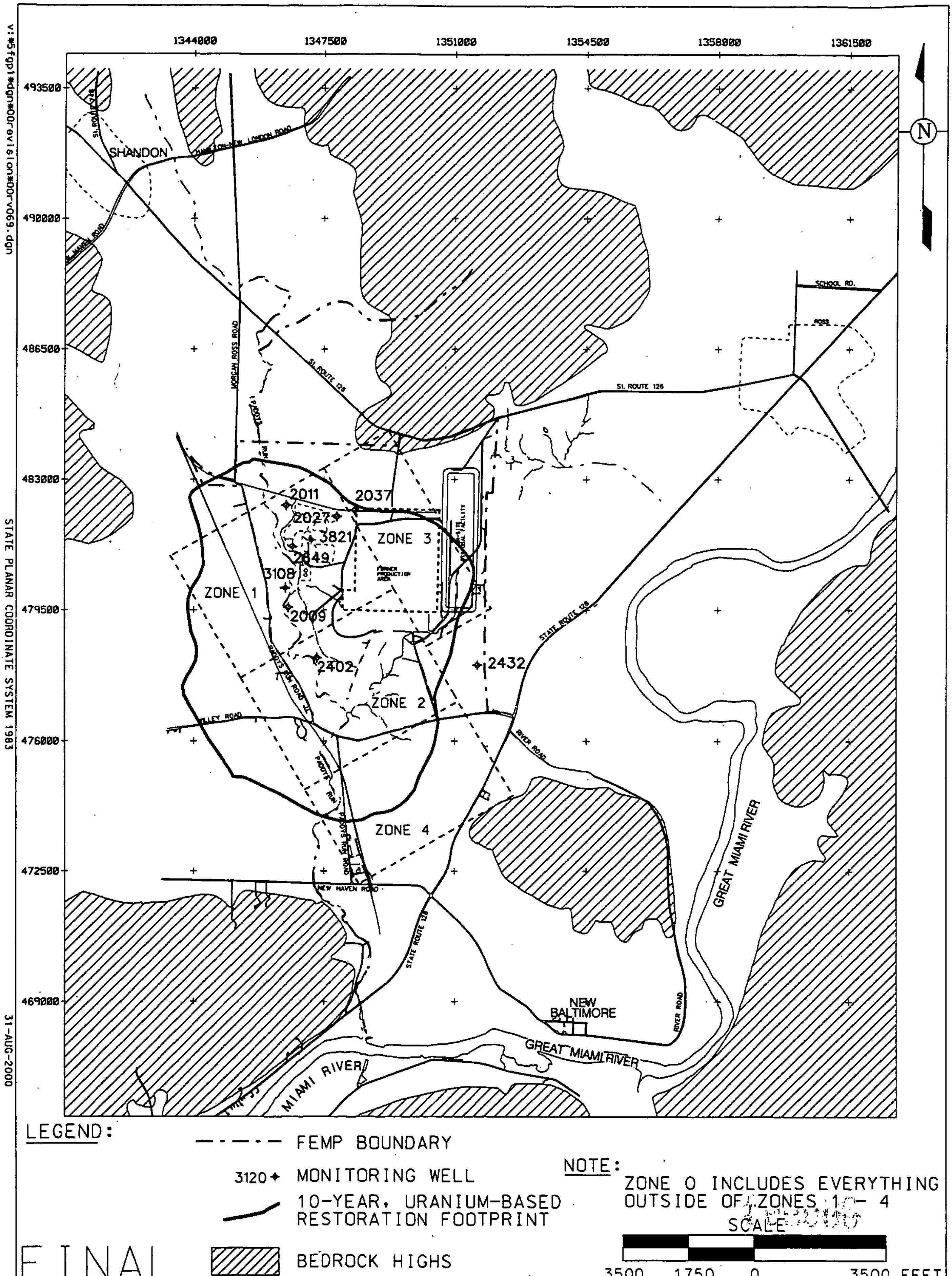
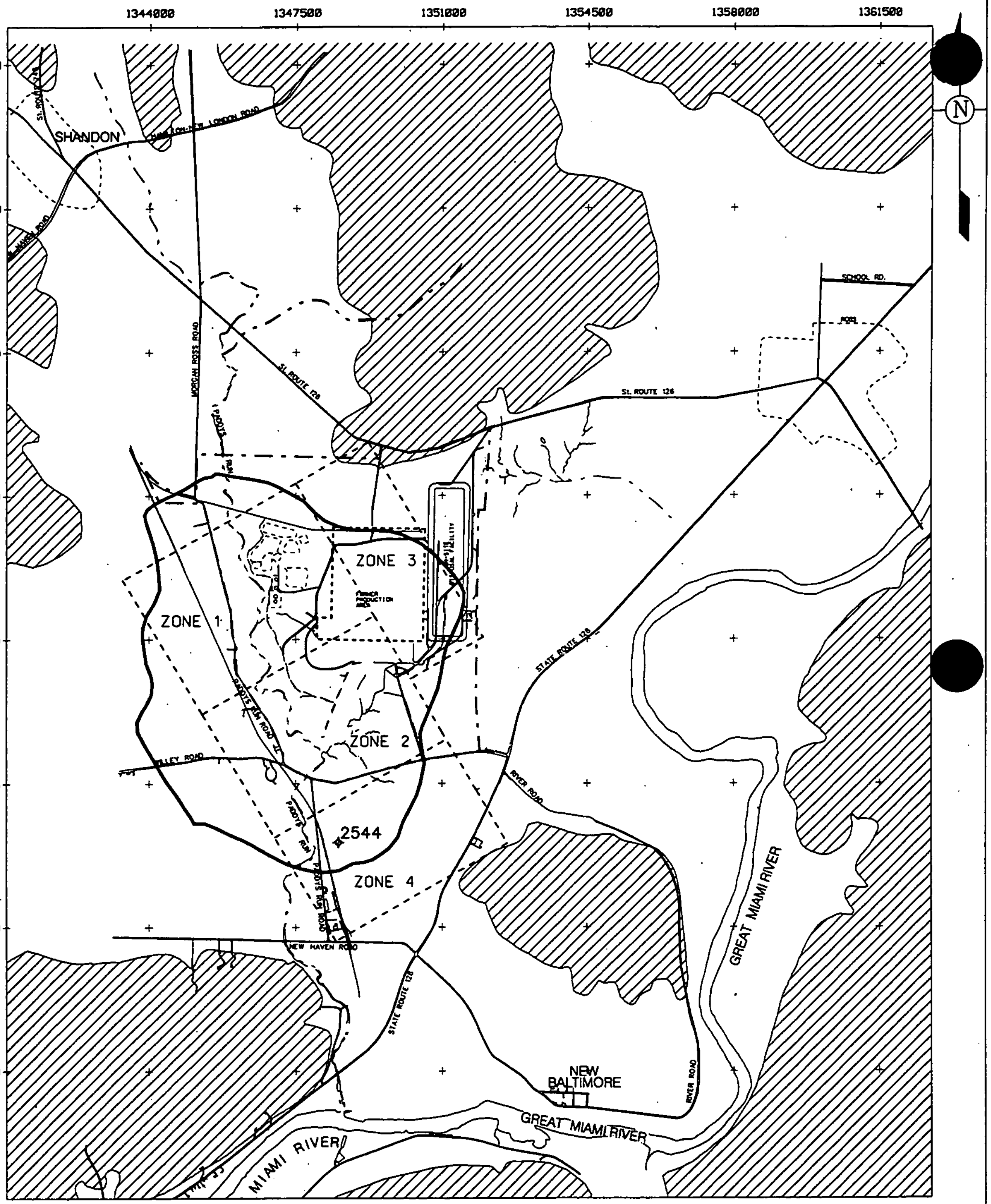


FIGURE A-30. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR CARBON DISULFIDE



v:\5fqp1\dgn\00revision\00rv070.dgn

STATE PLANAR COORDINATE SYSTEM 1983

31-AUG-2000

LEGEND:

- FEMP BOUNDARY
- 3120 ✦ MONITORING WELL
- 10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT
- BEDROCK HIGHS

NOTE: ZONE 0 INCLUDES EVERYT[HING] OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

000306

FINAL

FIGURE A-31. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR 1,1-DICHLOROETHENE

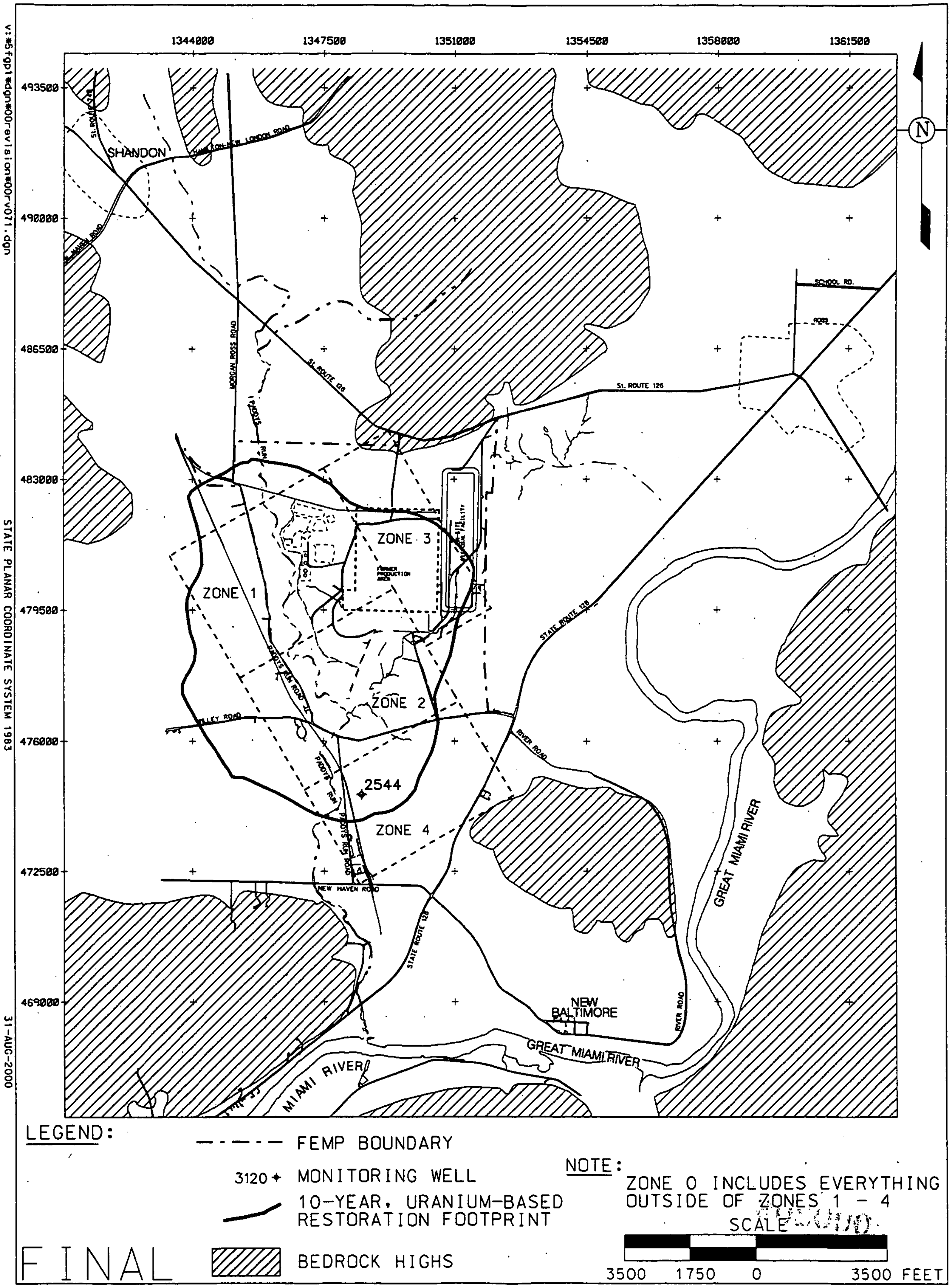
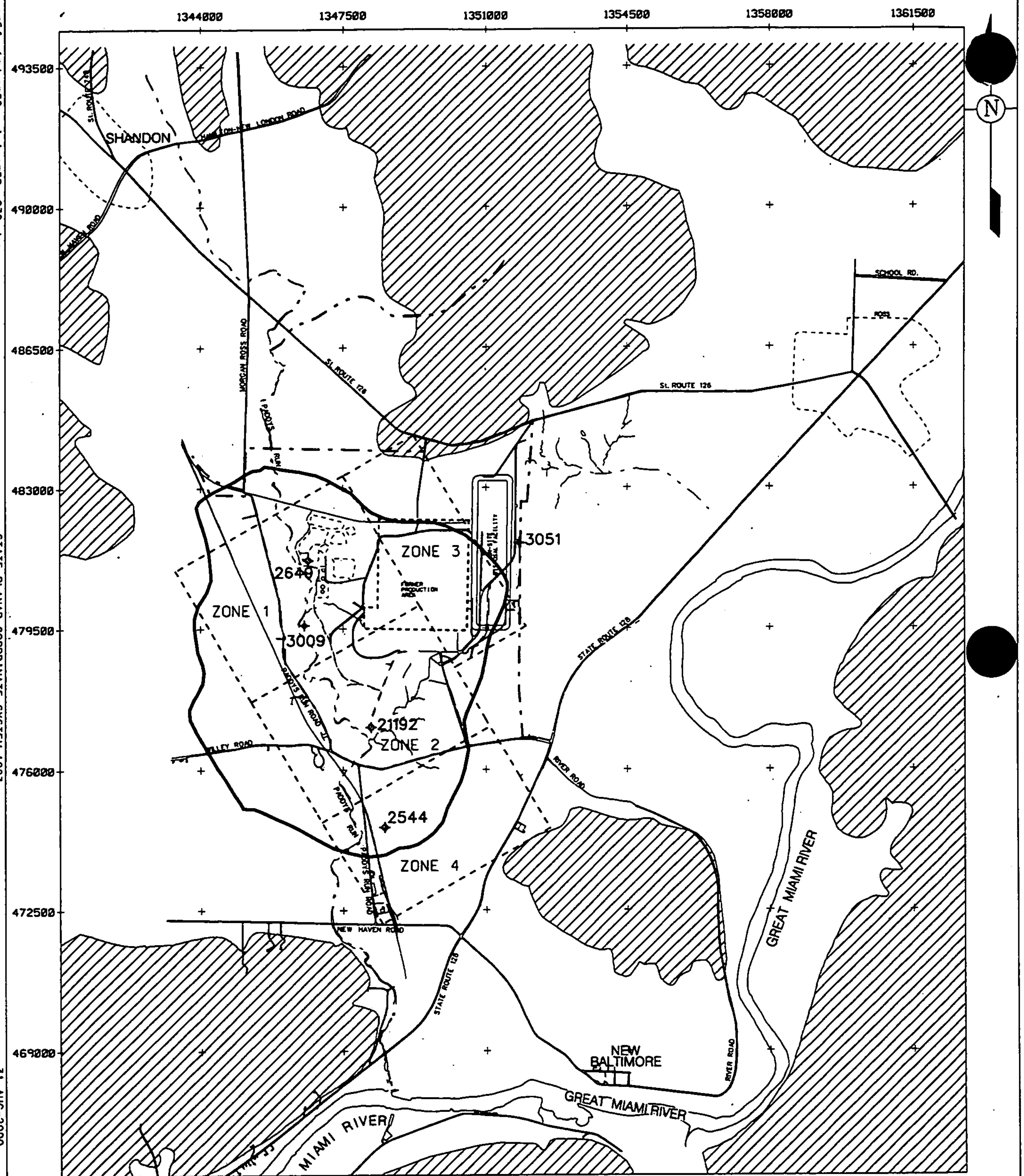


FIGURE A-32. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR 1,2-DICHLOROETHANE

v:\5fgp1\dgn\00revision\00rv072.dgn

STATE PLANAR COORDINATE SYSTEM 1983

31-AUG-2000



LEGEND:

FEMP BOUNDARY

3120 ✦ MONITORING WELL

10-YEAR, URANIUM-BASED RESTORATION FOOTPRINT

BEDROCK HIGHS

NOTE:
ZONE 0 INCLUDES EVERYT[illegible] OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

000308

FINAL

FIGURE A-33. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR TRICHLOROETHENE

Appendix B

APPENDIX B

SURFACE WATER FRL AND BTV EXCEEDANCES

APPENDIX B

SURFACE WATER FRL AND BTV EXCEEDANCES

This appendix provides further information regarding the final remediation level (FRL) and benchmark toxicity value (BTV) exceedances summarized in Table 4-2 as part of the constituent selection criteria for the Integrated Environmental Monitoring Plan (IEMP) surface water sampling program. As discussed in Section 4.4.2.3, a limited number of constituents have been detected above their respective FRLs and/or BTVs at sporadic surface water sample locations. To better quantify the actual number and location of exceedances, historical surface water data were compiled and compared to FRLs and BTVs to determine the number and locations of the exceedances. Due to the change in sampling programs over the years, surface water sample location identifiers have been renamed. Table B-1 provides a summary of this information pertaining to current IEMP sample locations.

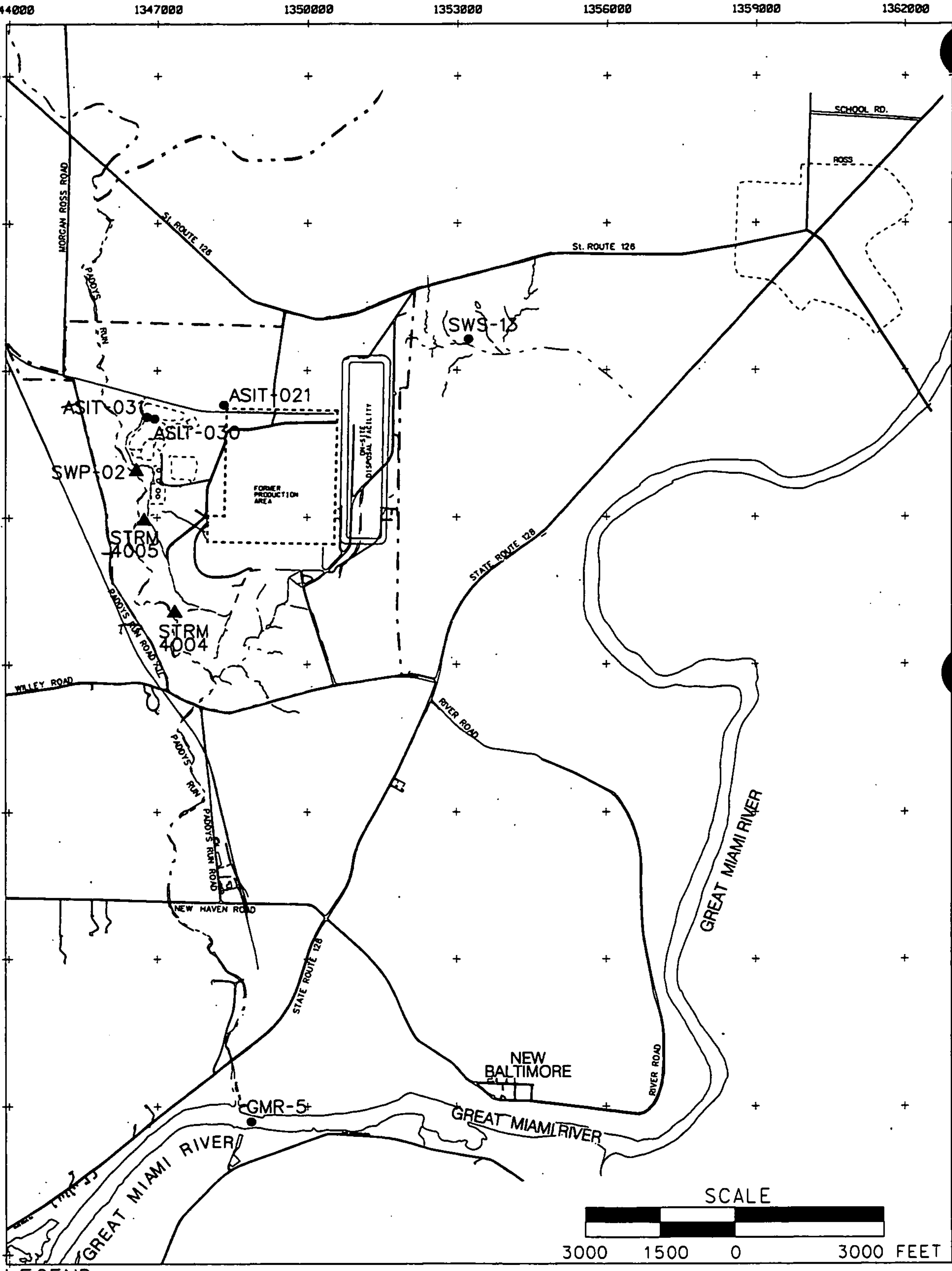
This appendix provides figures that document, by constituent, the particular sample location where FRLs and BTVs have been exceeded. On all of these figures, the number of exceedances is shown in parentheses for each location when the number of exceedances was greater than one. Samples collected prior to implementation of the IEMP are depicted as pre-1997 exceedances on each figure. Figures B-1 through B-15 show, by constituent, those locations with FRL exceedances, and Figures B-16 through B-18 show locations with BTV exceedances.

TABLE B-1

CROSS-REFERENCE OF SURFACE WATER SAMPLE LOCATIONS

Pre-IEMP Sample Location	IEMP Sample Location
SWS-5/W11	NA[a]
SWS-6/W7	SWP-03
SWS-7/W12	NA[a]
SWS-8/W14	NA[a]
ASIT-003	STRM 4003

[a]NA = not applicable



v:\5fqp1\dgn\00revision\00rv001.dgn

STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

LEGEND:

000311

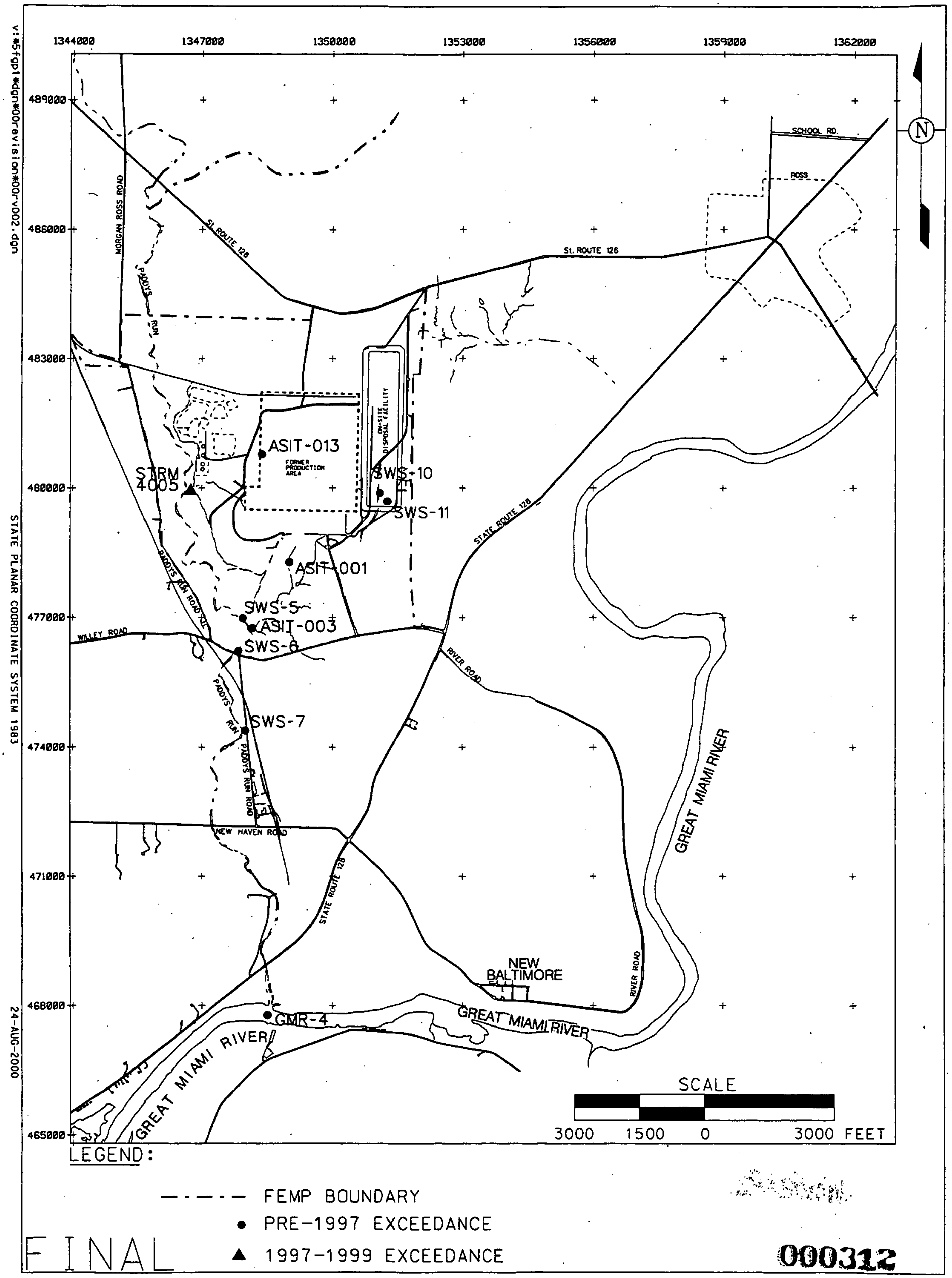
— - — - FEMP BOUNDARY

● PRE-1997 EXCEEDANCE

▲ 1997-1999 EXCEEDANCE

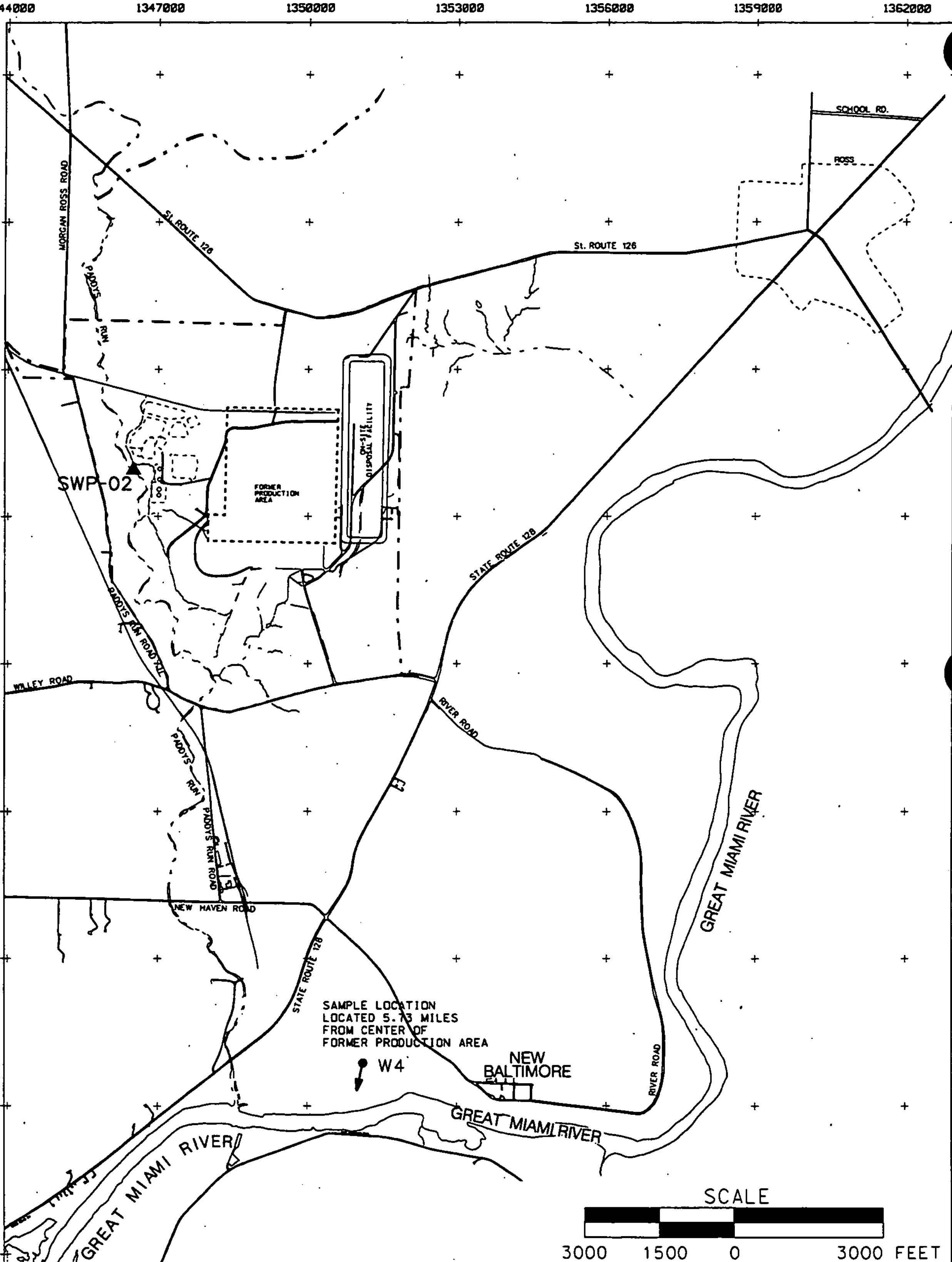
FINAL

FIGURE B-1. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR BERYLLIUM



000312

FIGURE B-2. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR BIS(2-ETHYLHEXYL)PHTHALATE



STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

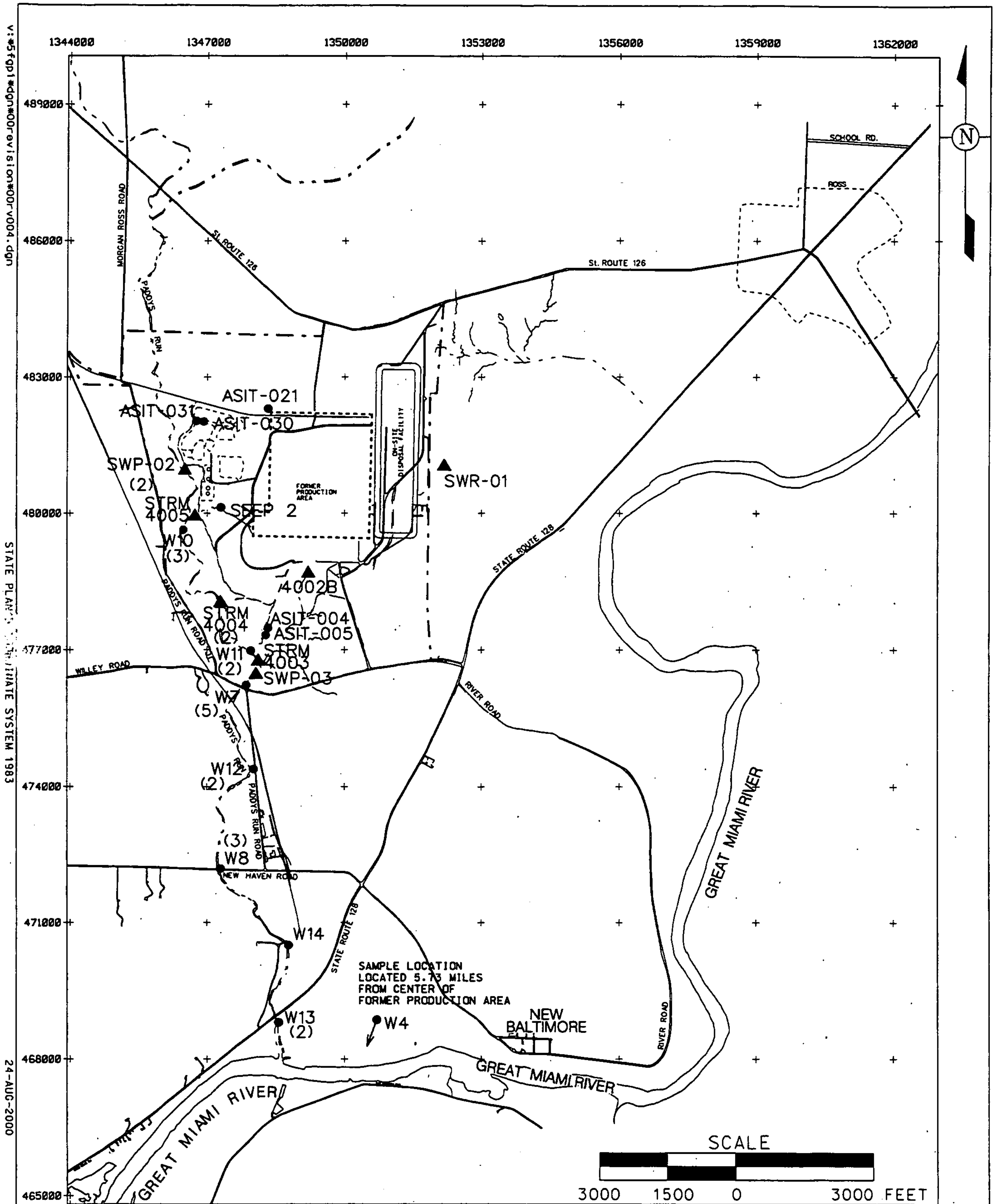
LEGEND:

- · - · - FEMP BOUNDARY
- ● PRE-1997 EXCEEDANCE
- ▲ 1997-1999 EXCEEDANCE

000313

FINAL

FIGURE B-3. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR CADMIUM



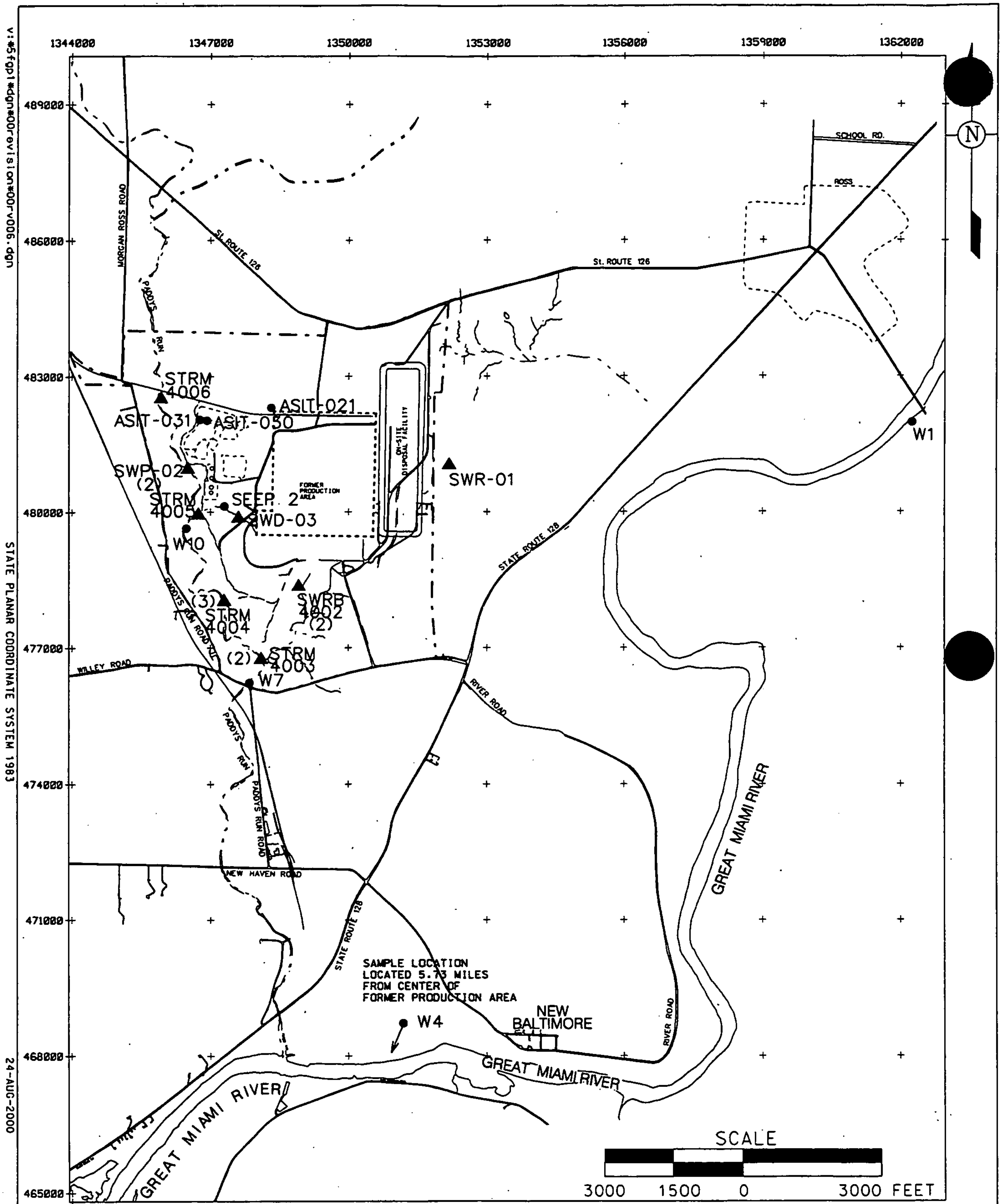
LEGEND:

- — · — · — FEMP BOUNDARY
- ● PRE-1997 EXCEEDANCE
- ▲ 1997-1999 EXCEEDANCE
- (2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

FINAL

000314

FIGURE B-4. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR TOTAL CHROMIUM



LEGEND:

- - - FEMP BOUNDARY

● PRE-1997 EXCEEDANCE

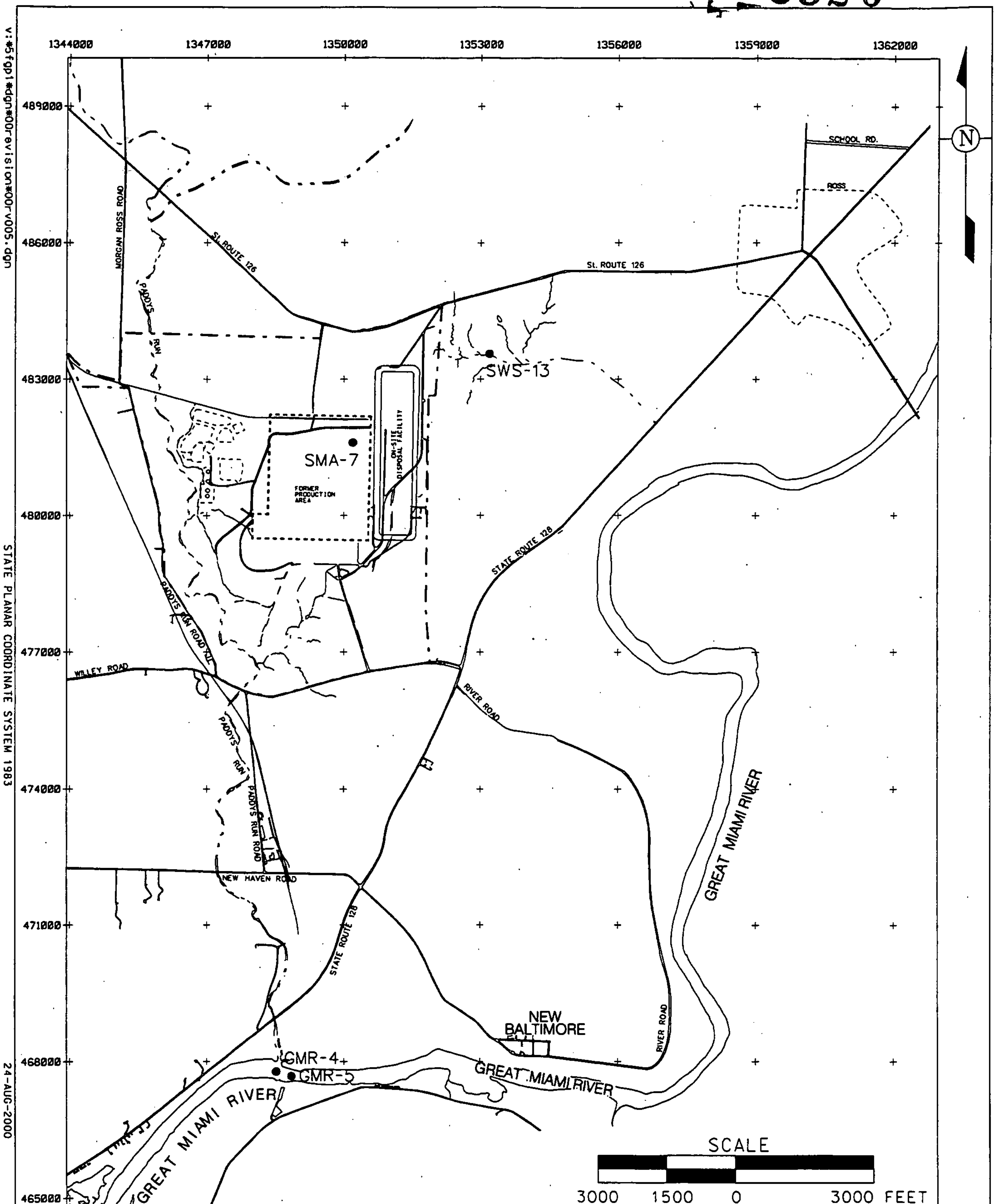
▲ 1997-1999 EXCEEDANCE

(2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

000315

FINAL

FIGURE B-5. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR COPPER



LEGEND:

— · — · — FEMP BOUNDARY

● PRE-1997 EXCEEDANCE

v:\5fgp1\dgn\00revision\00rv005.dgn

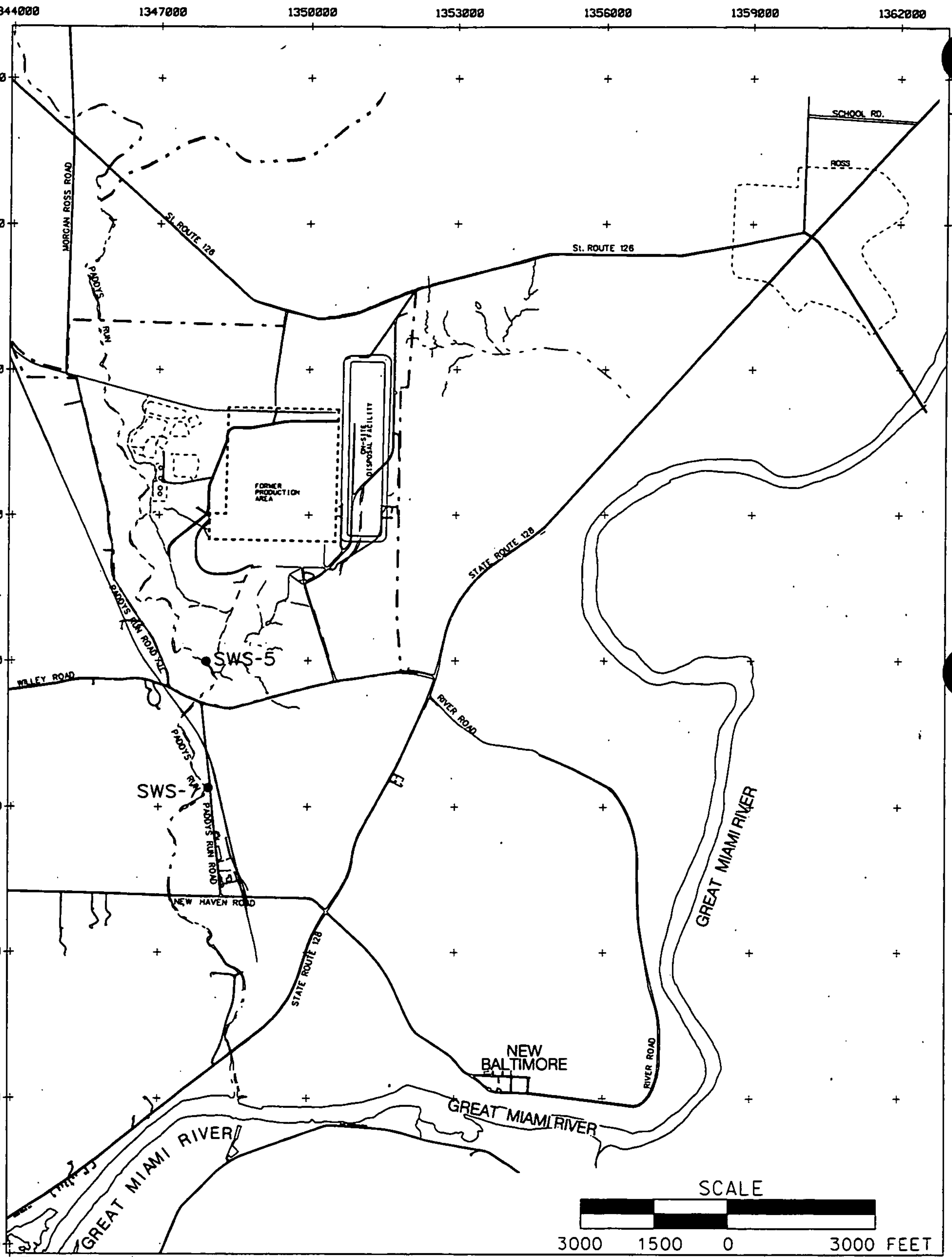
STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

FINAL

000316

FIGURE B-6. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR CYANIDE v:#5fop1#dgn#00revision#00rv008.dgn



LEGEND:

- · - · - FEMP BOUNDARY
- • PRE-1997 EXCEEDANCE

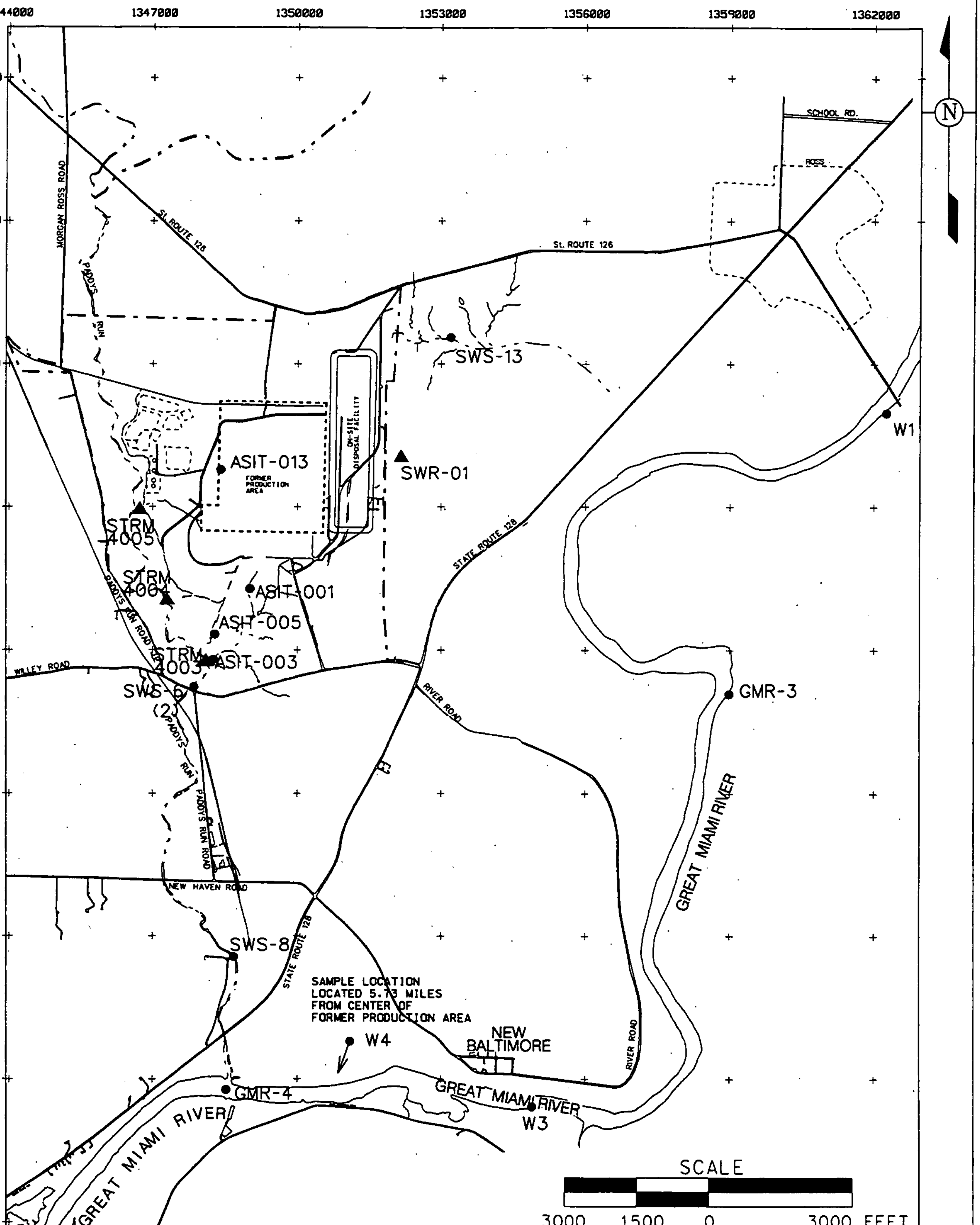
STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

000317

FINAL

FIGURE B-7. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR DI-N-OCTYLPHTHALATE



LEGEND:

FEMP BOUNDARY

● PRE-1997 EXCEEDANCE

▲ 1997-1999 EXCEEDANCE

(2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

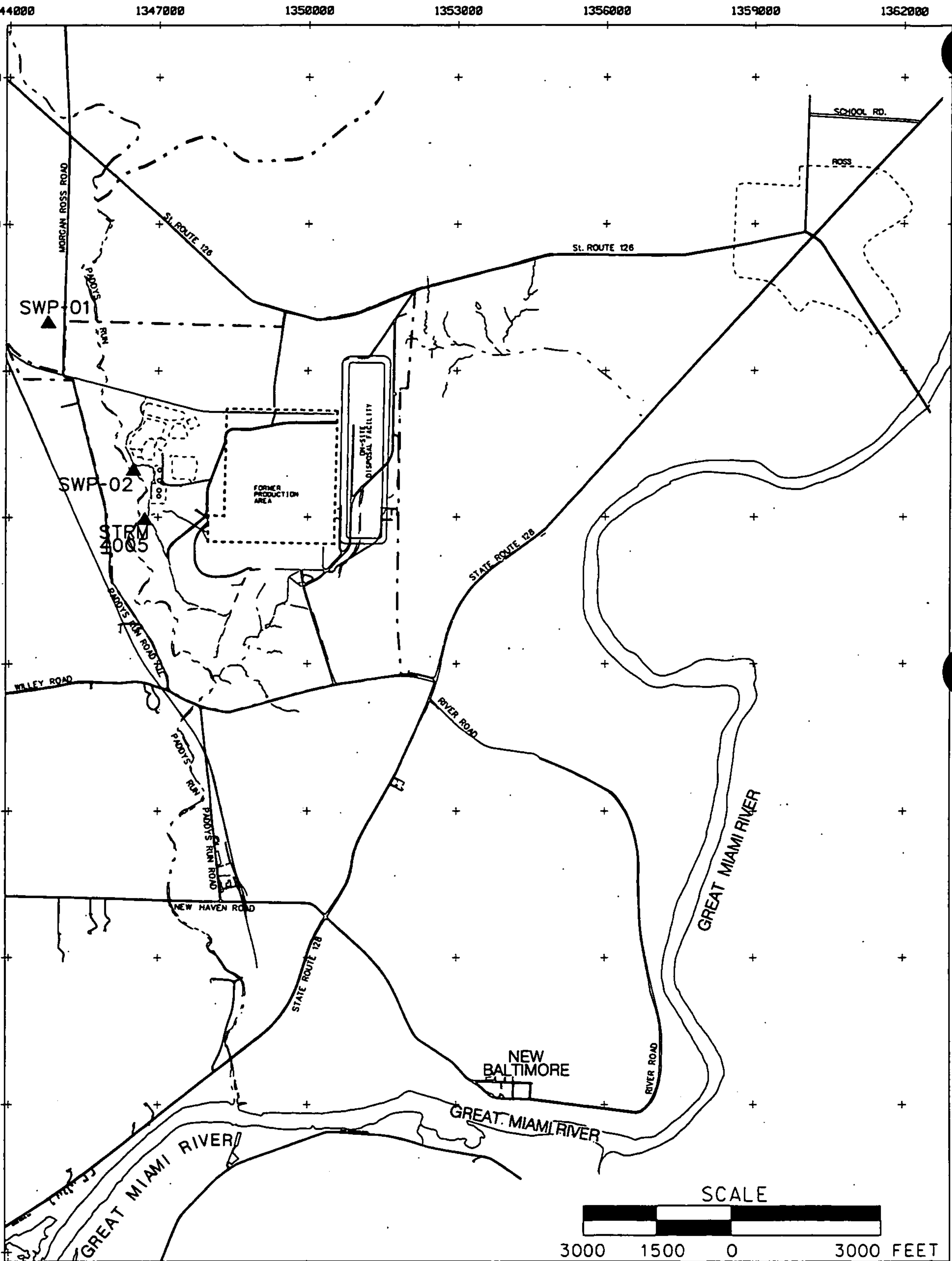
v:\5fgp1\dgn\00revision\00rv007.dgn

STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

FINAL

FIGURE B-8. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR LEAD



v:\5fop1\dgn\00revision\00rv010.dgn

STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

LEGEND:

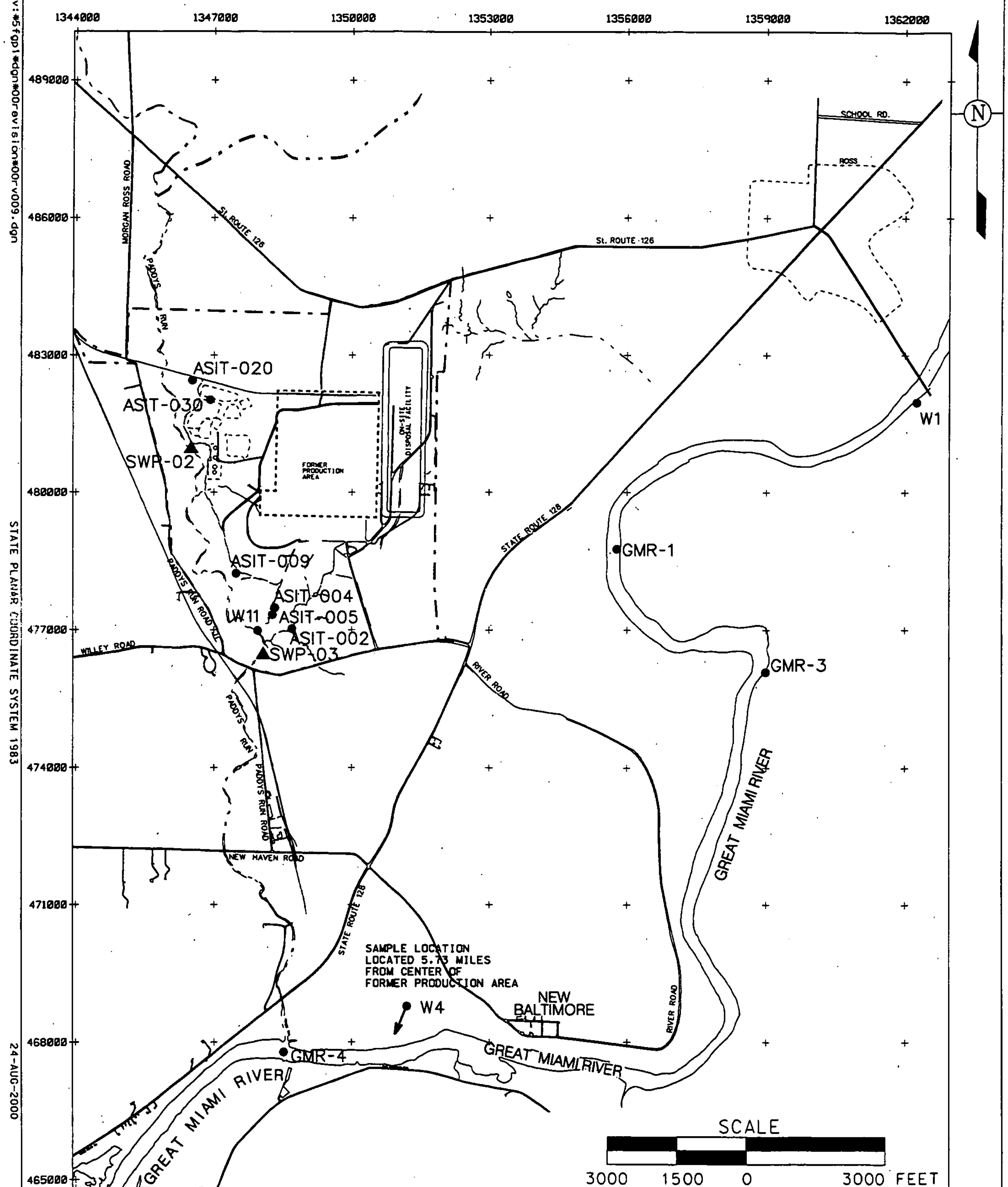
— - — - — FEMP BOUNDARY

▲ 1997-1999 EXCEEDANCE

000319

FINAL

FIGURE B-9. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR MANGANESE



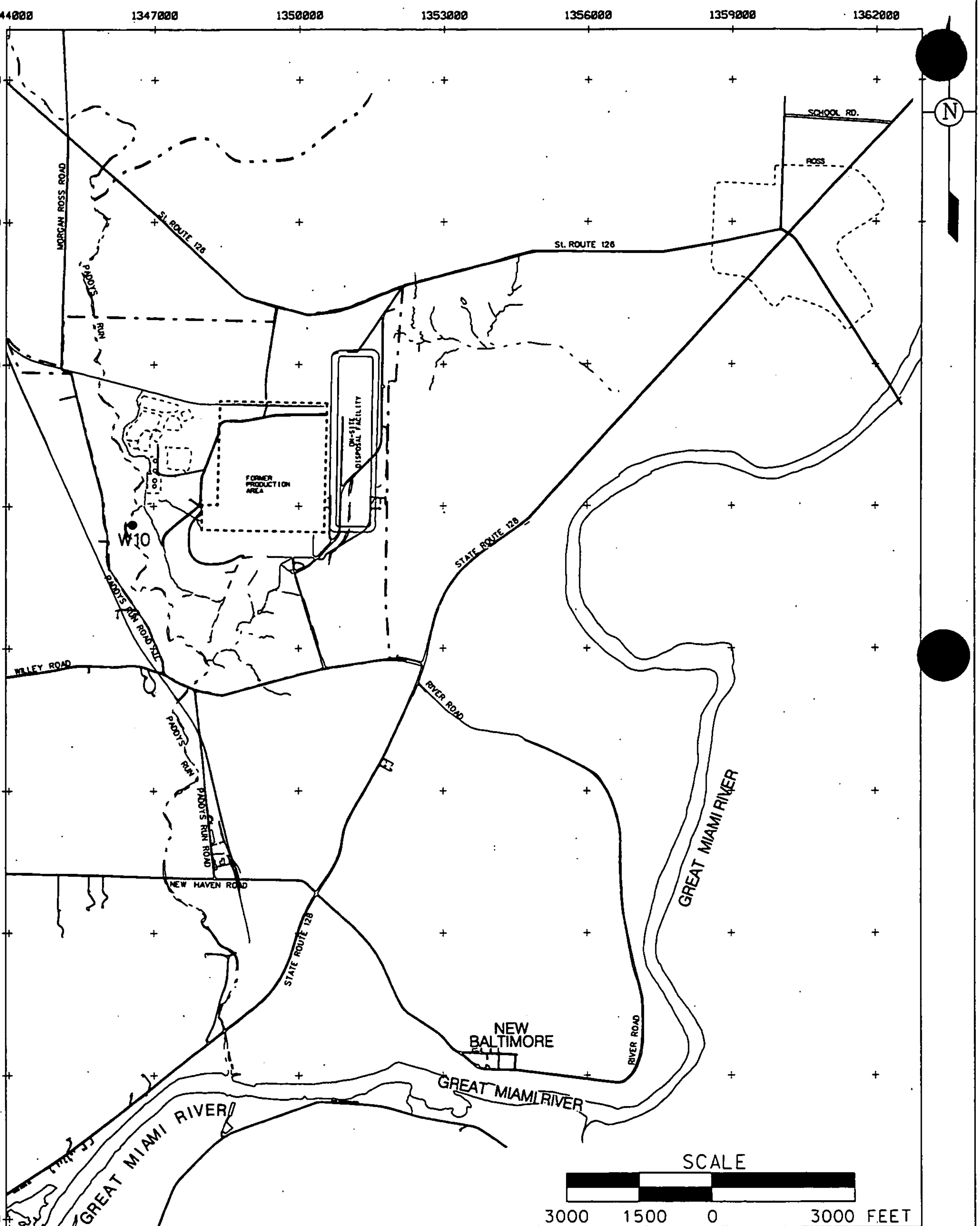
LEGEND:

- FEMP BOUNDARY
- ● PRE-1997 EXCEEDANCE
- ▲ 1997-1999 EXCEEDANCE

FINAL

000320

FIGURE B-10. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR MERCURY



LEGEND:

— · — · — FEMP BOUNDARY

• PRE-1997 EXCEEDANCE

(2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

v:\5fgp1\dgn\00revision\00rv012.dgn

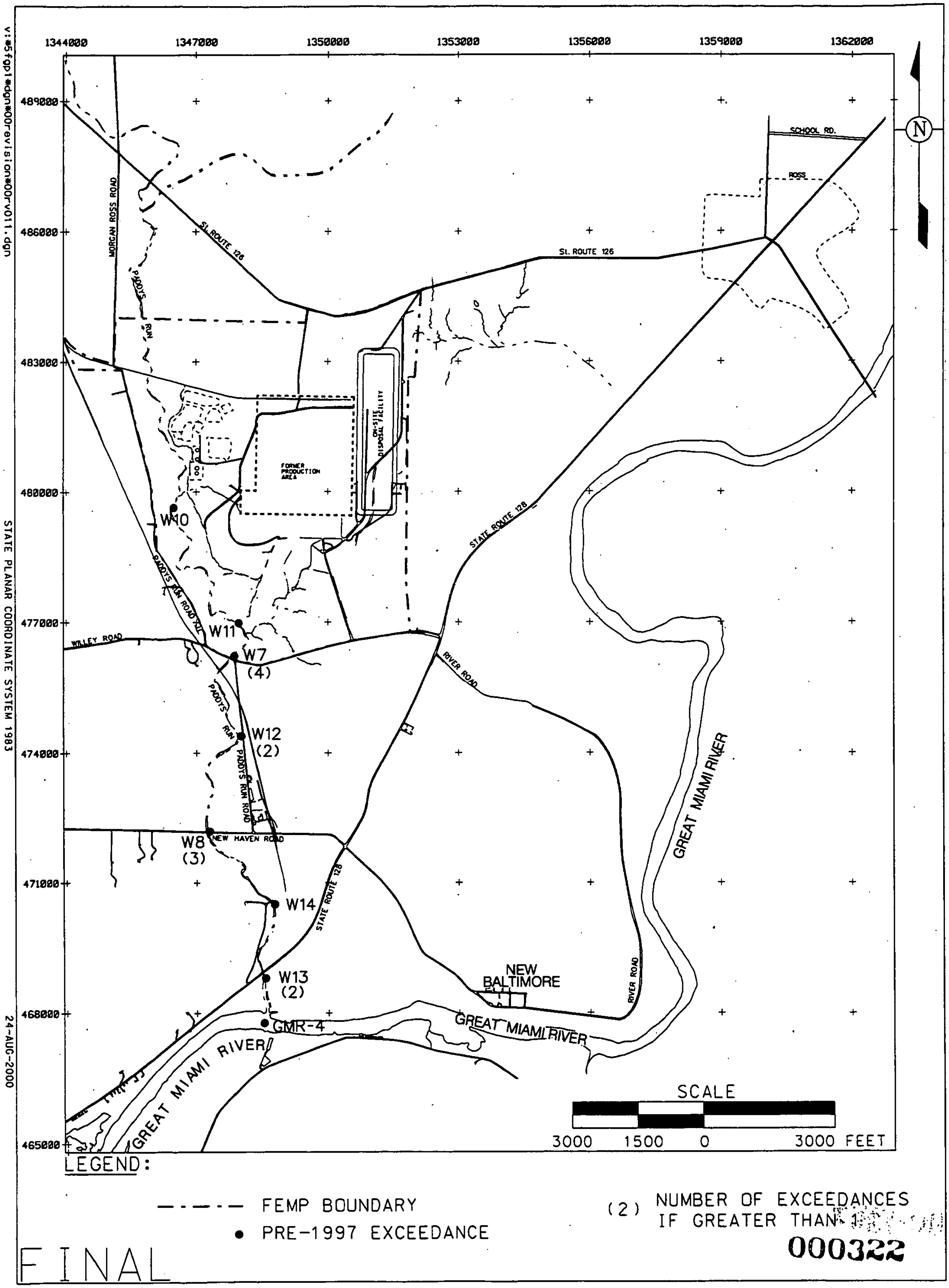
STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

000331

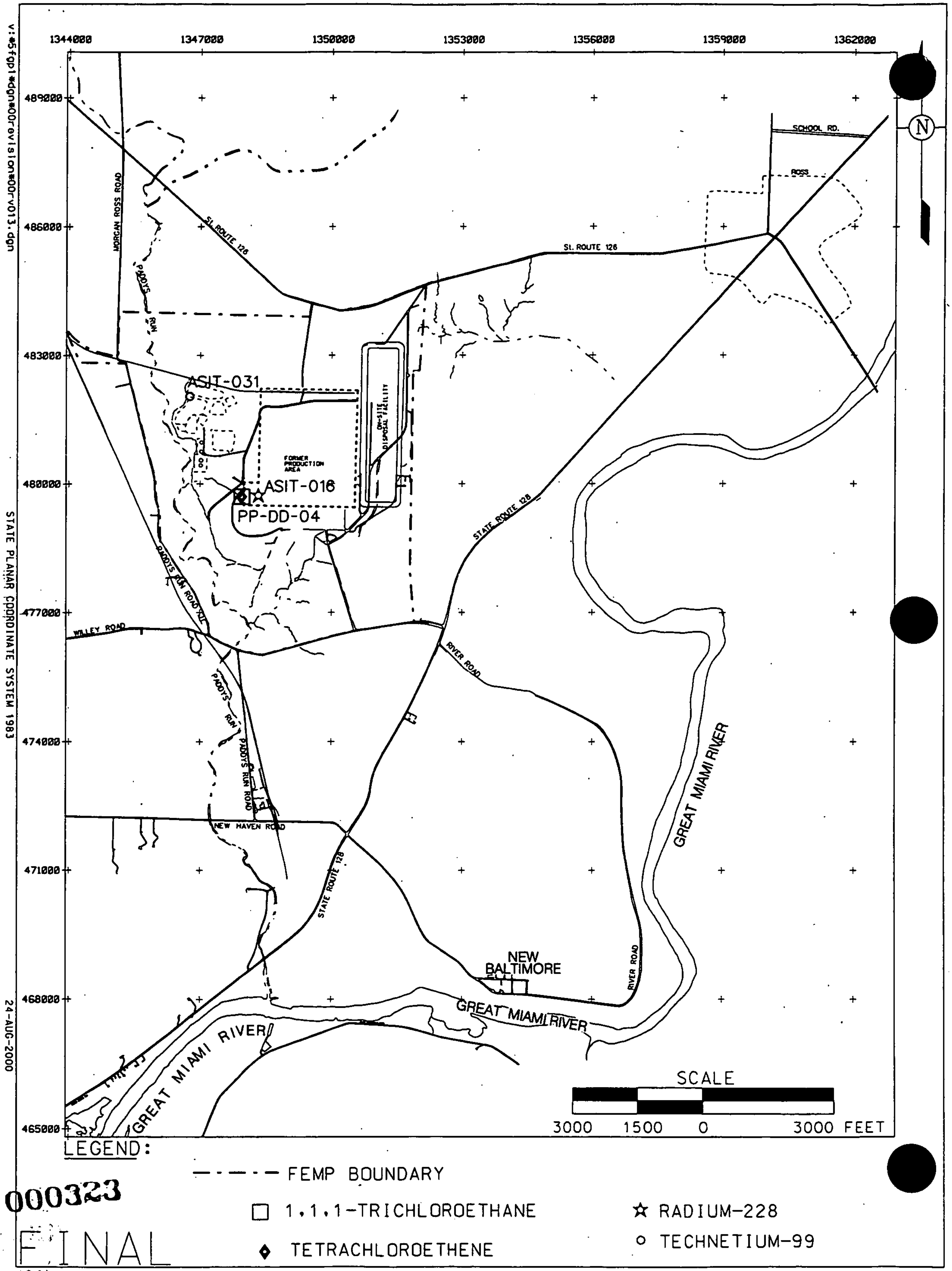
FINAL

FIGURE B-11. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR SELENIUM



000322

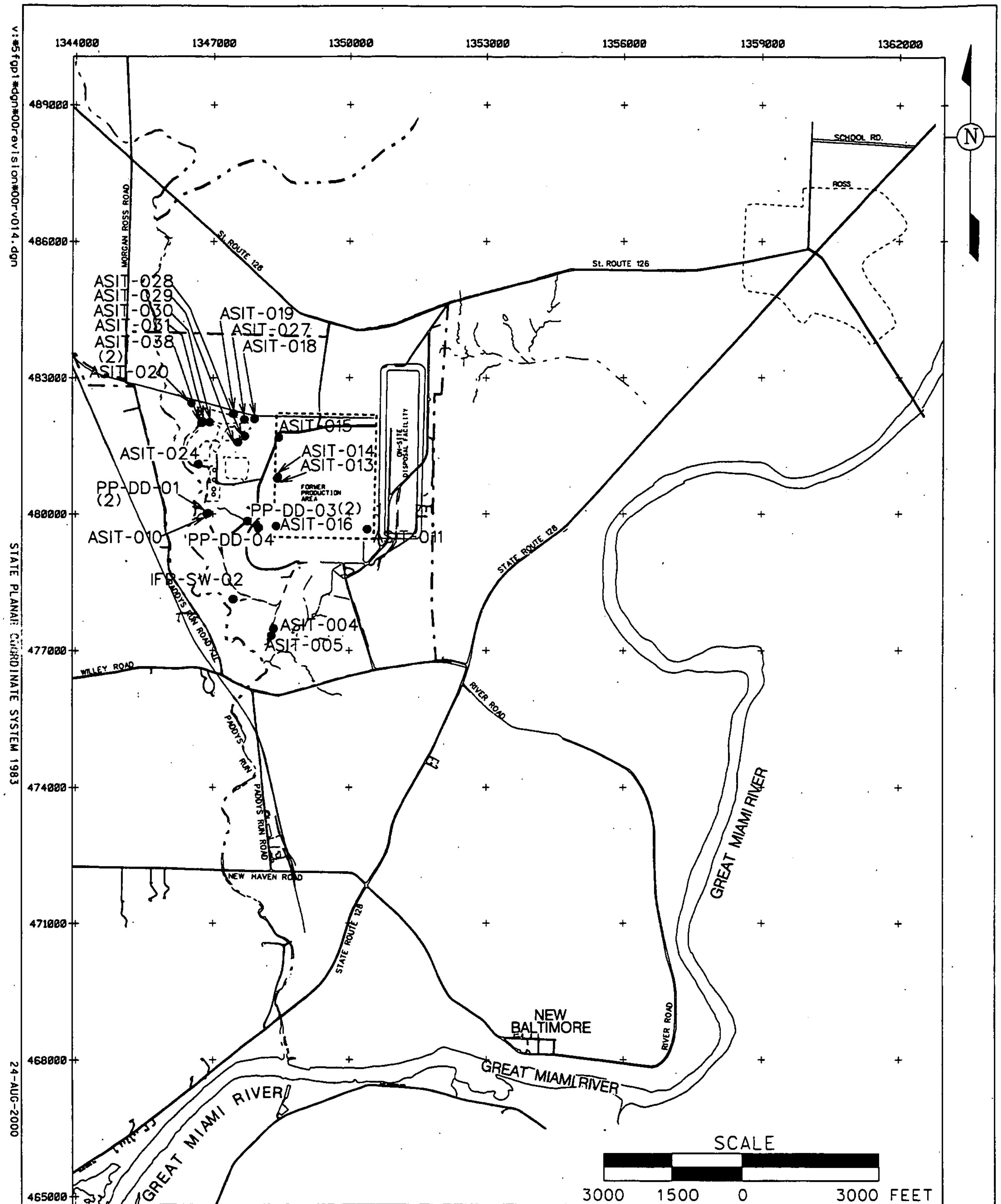
FIGURE B-12. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR SILVER



000323

FINAL

FIGURE B-13. SURFACE WATER LOCATIONS WITH PRE-1997 FRL EXCEEDANCES FOR 1,1,1-TRICHLOROETHANE, TETRACHLOROETHENE, TECHNETIUM-99 AND RADIUM-228



LEGEND:

— · — · — FEMP BOUNDARY

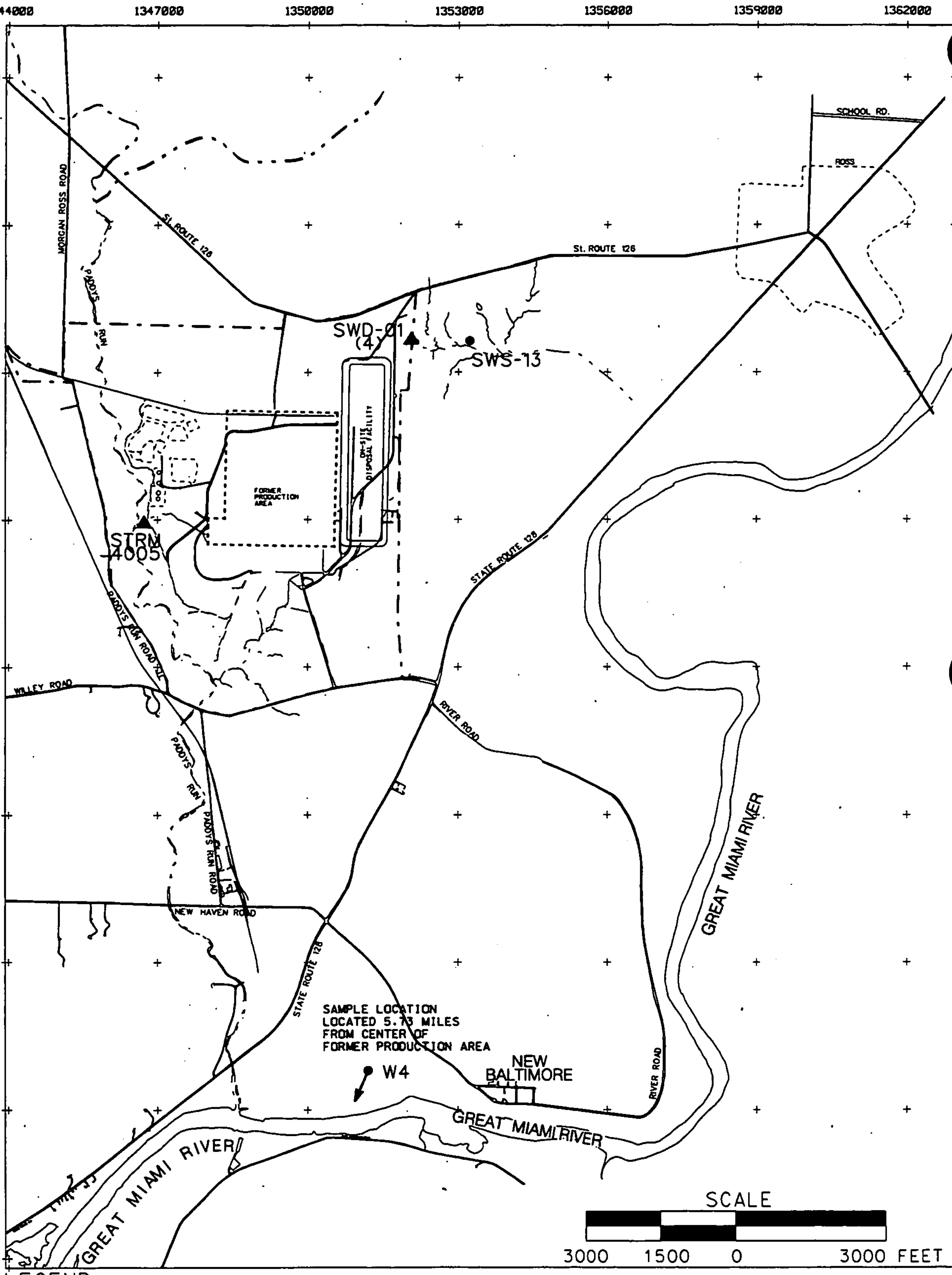
• PRE-1997 EXCEEDANCE

(2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

FINAL

000324

FIGURE B-14. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR TOTAL URANIUM



vi#5fgpl#dgn#00revision#00rv015.dgn

STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

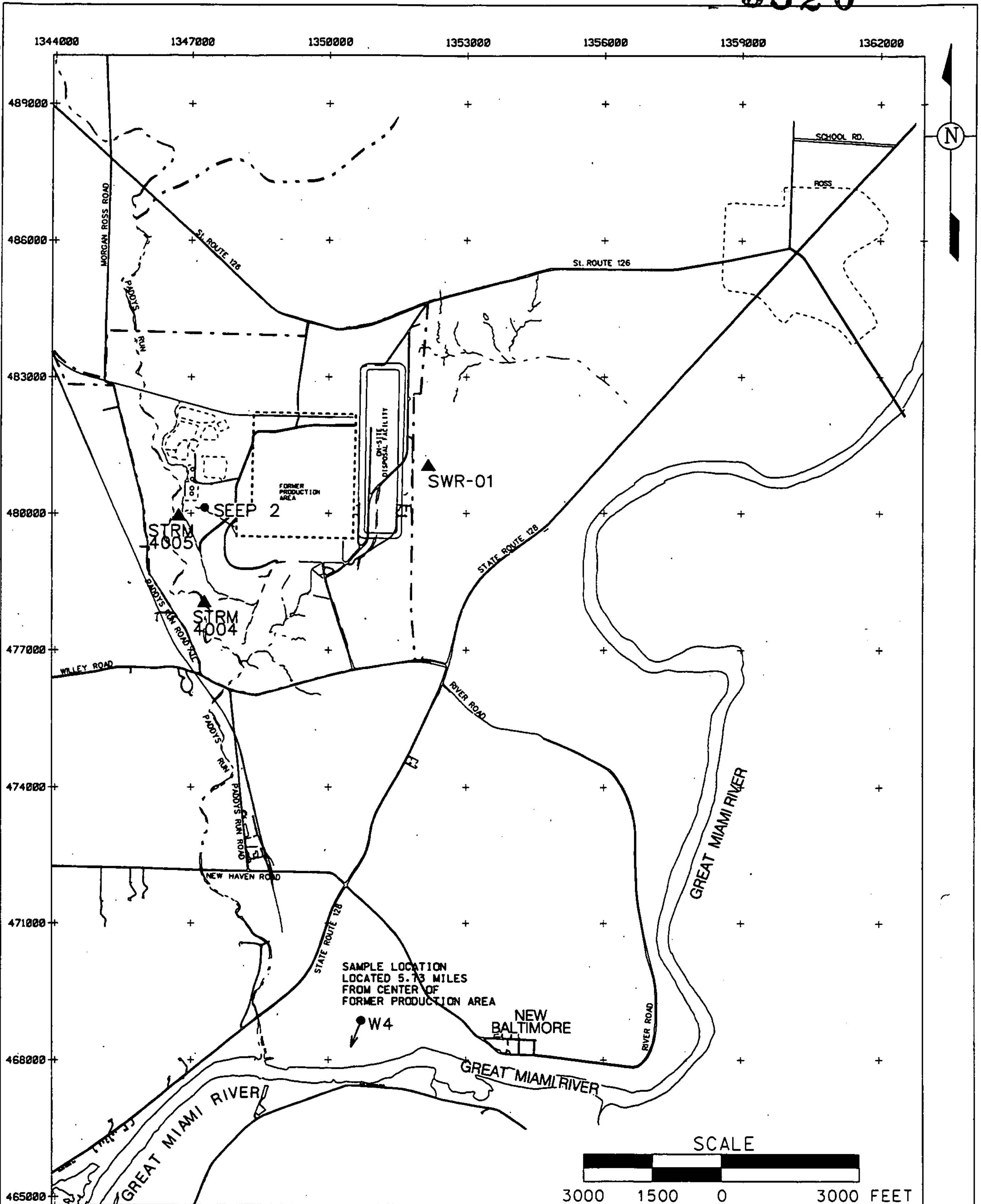
LEGEND:

- — - — FEMP BOUNDARY
- ● PRE-1997 EXCEEDANCE
- ▲ 1997-1999 EXCEEDANCE
- (2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

000325

FINAL

FIGURE B-15. SURFACE WATER LOCATIONS WITH FRL EXCEEDANCES FOR ZINC v:#5fgpl#dgn#00revision#00rv016.dgn



STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

LEGEND:

- — · — · — FEMP BOUNDARY
- ● PRE-1997 EXCEEDANCE
- ▲ 1997-1999 EXCEEDANCE

FINAL

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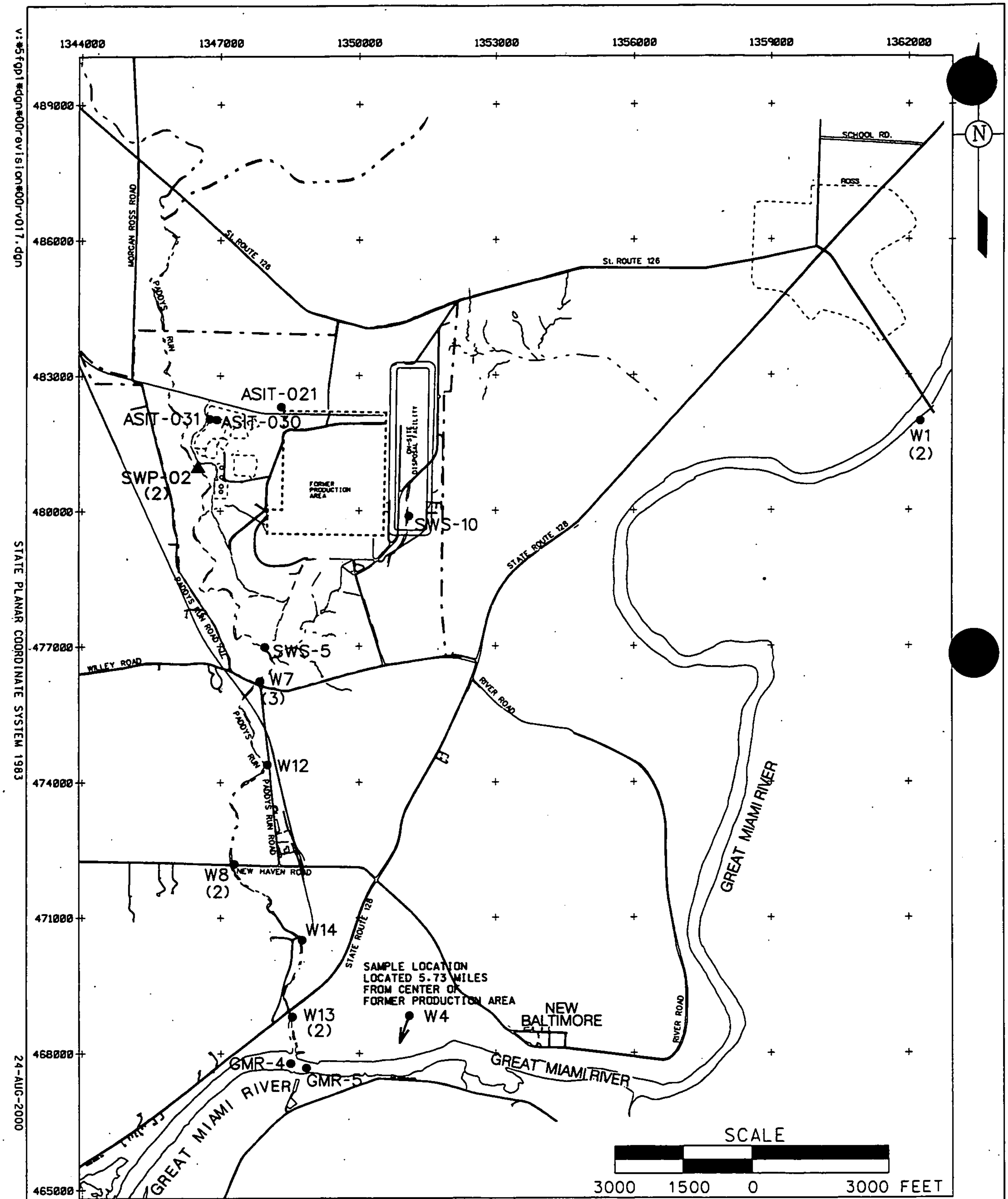
FIGURE B-16. SURFACE WATER LOCATIONS WITH BTV EXCEEDANCES FOR BARIUM

v:\5fop1\dgn\00revision\00rv017.dgn



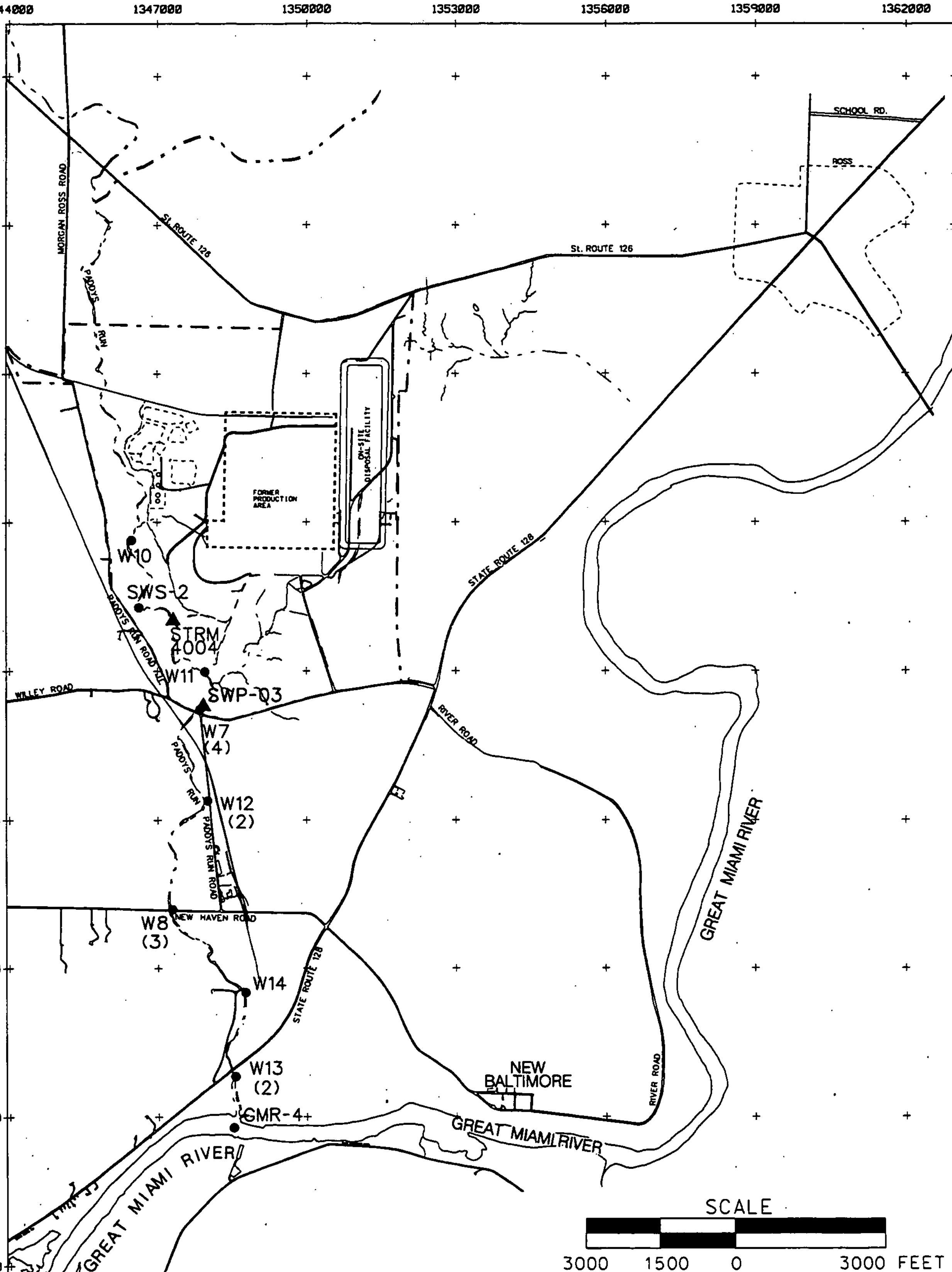
LEGEND:

- FEMP BOUNDARY
- ● PRE-1997 EXCEEDANCE
- ▲ 1997-1999 EXCEEDANCE
- (2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

000327

FINAL

FIGURE B-17. SURFACE WATER LOCATIONS WITH BTV EXCEEDANCES FOR CADMIUM v:\5fpl\dgn\00revision\00rv018.dgn



STATE PLANAR COORDINATE SYSTEM 1983

24-AUG-2000

LEGEND:

- · - · - FEMP BOUNDARY
- ● PRE-1997 EXCEEDANCE
- ▲ 1997-1999 EXCEEDANCE
- (2) NUMBER OF EXCEEDANCES IF GREATER THAN 1

FINAL

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FIGURE B-18. SURFACE WATER LOCATIONS WITH BTV EXCEEDANCES FOR SILVER

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Appendix C

APPENDIX C

DOSE ASSESSMENT

APPENDIX C

DOSE ASSESSMENT

C.1 INTRODUCTION

This appendix describes the technical approach for conducting the annual radiological dose assessment to meet the intentions of U.S. Department of Energy (DOE) Order 5400.5 and the air pathway compliance determination (for 40 Code of Federal Regulations [CFR] 61 National Emissions Standards for Hazardous Air Pollutants [NESHAP] Subpart H) during the active remediation of the Fernald Environmental Management Project (FEMP). The Integrated Environmental Monitoring Plan (IEMP) will be the vehicle for conducting and reporting the annual sitewide radiological dose assessments.

The application of effective source and emission control-measures, coupled with appropriate initial planning and on-going preventive tracking, will form the cornerstone of the FEMP's environmental safeguards during remediation.. The objective of the dose assessment under the IEMP is to support these safeguards during remediation and to provide appropriate feedback, when necessary. The FEMP's current compliance-based method for conducting the site's annual dose assessment (which, by definition, is performed at the end of the calendar year to report the results of past activities) will be supplemented with tracking and evaluating actual monitoring data collected at the site fenceline during the year to identify any need for improving source emission control measures to ensure that the annual NESHAP dose limit is never reached.

C.2 REGULATORY DRIVERS AND REQUIREMENTS

Radiological dose assessments are prepared annually at the FEMP to establish that doses to the public from routine operations and emissions are in compliance with the dose limits set by the U.S. Environmental Protection Agency (EPA) and DOE regulations and orders. Before 1998 radiological dose assessments conducted at the end of the year were based on modeling results that used measured and estimated releases of airborne radioactive materials from significant sources. The various radiological dose limits and guidelines defined in the applicable or relevant and appropriate requirements (ARARs) and other regulatory requirements accompanying the FEMP's remediation activities are described in this section.

In addition to the regulatory-based drivers for the FEMP's annual dose assessment, the need for a dose tracking procedure that can be utilized as a preventive tool has been identified. .Dose tracking is needed to help prevent exceedance of the annual radiological dose limits and to identify the expected significant contributors for each year's combination of remediation activities. Based on the dose tracking results, any additional source control measures or adjustment in project-specific activities can be made as necessary to ensure that the FEMP's contributions to annual dose remain within prescribed limits.

C.2.1 ARARs and Other Regulatory Drivers

This subsection summarizes the ARARs and other regulatory drivers for the dose assessment and associated dose limits. A sitewide radiological dose assessment is needed to demonstrate compliance with the following limits and guidelines from DOE Order 5400.5, which incorporates dose assessment standards in 40 CFR 61 NESHAP, Subpart H:

- The exposure of members of the public to radiation sources as a consequence of all routine activities at a DOE site shall not cause, in a year, an effective dose equivalent greater than 100 millirem (mrem). This annual effective dose equivalent is defined as the sum of direct external exposure for the year, plus the committed effective dose equivalent for intakes experienced during the year.

  The guideline includes doses from remediation activities and naturally occurring radionuclides released by DOE processes, but not radon and its decay products. All pathways that could significantly contribute to the exposure are to be included in the calculations. Significant exposures are considered to be one percent of the 100 mrem (one mrem) dose limit or greater.

- The exposure of members of the public to radioactive materials released to the atmosphere as a consequence of all activities at a DOE site shall not cause, in a year, an effective dose equivalent greater than 10 mrem. Because this guideline implements the dose limits of 40 CFR 61 Subpart H, doses caused by radon-222 and its decay products are not included. The same annual effective dose equivalent definition applies as above.

  Note: The radon effluent guidelines of DOE Order 5400.5 also implement the EPA flux regulations of 40 CFR 61, Subpart Q, which apply to radon-producing wastes during storage or disposal. These guidelines are expressed in terms of radon concentrations in air and radon flux at the surface of radon-producing wastes, not in terms of dose to humans or other organisms.

- The liquid effluents from DOE activities shall not cause private or public drinking water systems to exceed the drinking water radiological limits in 40 CFR 141. That is, effluents must not cause the drinking water to exceed any of the following independent limits: man-made beta/gamma-emitting radionuclides at an annual average concentration that would cause an annual dose equivalent of 4 mrem to the total body or any internal organ, combined radium-226 and radium-228 at any time totaling 5 picoCuries per liter (pCi/L), or gross alpha activity (including radium but excluding radon and uranium) of 15 pCi/L at any time.

- The absorbed dose to native aquatic organisms shall not exceed one rad per day from exposure to the radioactive material in liquid wastes discharged to natural waterways. For the purposes of satisfying this requirement, the term "native aquatic organisms" (which is not otherwise defined by DOE) is interpreted to mean insects, macro-invertebrates (i.e., crayfish, shellfish, etc.), finned fish or mammals.

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C.2.2 Remediation Support Requirements

During FEMP remediation, routine dose assessments using actual monitoring data will also be conducted more frequently to verify the effectiveness of the source control measures implemented by individual remediation projects and to prevent exceedance of the annual dose limits.

During the year, actual monitoring data at fenceline monitoring locations as defined in Section 6.0 will be evaluated at least quarterly. When determined necessary, the source emission control measures for selected remediation projects will be revised to reduce the chance of exceeding the annual dose limit. At the end of the year, the actual air monitoring data will also be directly used to determine the annual dose for the 40 CFR 61 NESHAP Subpart H compliance demonstration.

C.3 GENERAL TECHNICAL APPROACH

This section presents a discussion of the general technical approach to be followed for performing the dose tracking and actual annual dose assessment. The discussion includes an explanation of exposure pathways and media important to the dose assessment, surveillance and characterization of these pathways, and the dose calculation procedure.

C.3.1 Exposure Pathways During Remediation

Establishment of representative exposure pathways is important for performing the dose assessment. A typical exposure pathway consists of a specific source, medium of transport, and a defined receptor. During the course of remediation, conditions at the FEMP's contaminant sources may be altered both temporarily (during the action) and permanently (as a result of the action). Therefore, representative definitions of remediation-specific exposure pathways are needed to support accurate projections of radiological dose. Because contaminant source conditions can vary each year due to the mix of remediation activities in a given year, representative definitions of remediation-specific exposure pathways will be reevaluated each year during the initial annual sitewide planning and dose projection.

C.3.1.1 Remedial Project-Specific Sources

Specific remedial operations will be conducted at the FEMP to achieve the final cleanup goals. These remedial operations will present new potential emissions sources in addition to the traditional sources evaluated for NESHAP compliance. Following is a list of the major types of remediation operations that may have significant emissions:

- Building decontamination and dismantling
- Soil and waste material excavation
- Waste treatment

- Construction of the on-site disposal facility
- Waste transportation.

It is important to emphasize that the scope of the IEMP does not include the project-specific emission control monitoring (such as that specified in the Best Available Technology Determination for Remedial Construction Activities) that will be performed by the individual projects. The individual projects will also be responsible for applying the appropriate emission controls within a remediation activity to achieve compliance with project-specific regulatory requirements for workers' protection and environmental emissions. As a feedback mechanism for the projects, in the event that the routine IEMP dose tracking results indicate a pending unacceptable annual cumulative impact, follow-up project-specific analyses will be conducted to determine the possible causes. Then, the results of the analysis will be provided to the specific remedial projects and they will be responsible for further adjusting their control measures or activities to bring cumulative projections within acceptable limits.

C.3.1.2 Media-Specific Pathways

Effective source control measures for each remedial action will be implemented and maintained during FEMP remediation. (The IEMP monitoring and dose tracking activities are designed to appraise the cumulative effectiveness of these control measures.) As a result of the FEMP's obligation to apply such measures, the potential impacts resulting from remediation activities are not expected to appreciably increase in any of the media-specific pathways from historical levels. Therefore, the historical monitoring results summarized in the past annual site environmental reports can be used to select the FEMP's significant exposure pathways (i.e., those pathways with the potential to contribute one percent or more of regulatory-based dose limits, as prescribed by DOE guidelines) to be routinely monitored and included in the annual dose calculation procedure under the scope of the IEMP.

According to the previous annual dose assessments and remedial investigation/feasibility studies performed at the FEMP, the potential exposure pathways to human receptors are through the air (inhalation and ingestion) and by direct radiation. These potential media-specific pathways are summarized below:

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Air Pathway

Potentially significant exposure (i.e., above one percent of the all-pathway combined dose limit of 100 mrem) to humans through the air pathway during remediation may result from:

- Inhalation of contaminated fugitive dust from soil excavation, building decontamination and dismantling, temporary soil storage piles, on-site disposal facility construction and waste pits (dose attributable to airborne emissions is subject to 40 CFR 61, Subpart H limit of 10 mrem per year)
- Inhalation of stack and vent releases
- Ingestion of foodstuff contaminated by direct deposition onto crops
- Ingestion of foodstuff contaminated indirectly by deposition onto soil where crops are grown.

Note: Exposure through consumption of meats and milk from animals that consumed contaminated feed (assuming all contaminated by air deposition instead of irrigation using contaminated water) has been shown to be consistently insignificant (i.e., less than half of the 0.2 mrem total 1995 dose in the foodstuffs ingestion pathway), according to existing monitoring data.

Direct Radiation Pathway

Exposure from direct radiation may result from:

- Direct radiation from materials stored at the FEMP, especially materials in the K-65 Silos
- Direct radiation from contaminated soil and sediment.

C.3.1.3 Potential Receptors

Potential receptors to be considered in the radiological dose assessment during the FEMP remediation will include actual and hypothetical off-property residents. The hypothetical receptors are usually selected to demonstrate the worst possible dose at locations of the measured or calculated maximum air concentrations even when there is no actual receptor at those locations. The NESHAP compliance demonstration will be based on fenceline measurements although there are no actual receptors on the fenceline. The IEMP air monitoring network will focus on monitoring at the fenceline to ensure limits are not exceeded, thereby ensuring the levels at the actual off-property residents are also below the limits. The exposure scenarios and parameters (i.e., duration of exposure and potential food sources) will be generally conservative as used in the previous dose assessments.

C.3.2 Routine Surveillance of Pathways

The environmental media that have the potential to lead to a significant annual dose (greater than one percent of the all-pathway combined dose limit of 100 mrem) at the site boundary and representative potential receptor locations will be routinely sampled and analyzed for the constituents contributing to the dose. Sections 3.0 through 7.0 of the main text describe the media-specific monitoring programs under the IEMP. All the significant pathways listed in Section C.2.1.2 will be monitored under the IEMP.

In general, the routine surveillance under the IEMP will include both environmental sampling/analysis and preventive tracking/feedback. The frequency of monitoring and evaluation will be selected to satisfy the regulatory drivers, as well as, remediation support requirements.

The data for the dose assessment will be based on measurements of radionuclide concentrations in environmental media at on-property and boundary/receptor monitoring locations (as presented in Sections 3.0 through 7.0), rather than in effluent samples obtained at specific sources (i.e., stacks), for the following reasons:

- Dose assessments based on measured radionuclide concentrations in environmental media are less uncertain than those based on effluent measurements. Assessments based on environmental monitoring avoid the use of the transport and bioaccumulation models required by effluent-based calculations, thereby reducing the overall uncertainty in the results.

- The potential exists for unmonitored releases from the FEMP, and the impact of all releases must be accounted for. Examples of potential unmonitored releases include releases from open waste pits, fugitive releases from remediation activities, and any releases from demolition projects in the former production area. In an effluent-based method, releases from such pathways must be conservatively estimated, which again contributes to the uncertainty of the results and over-estimates the impact.

- Calculations based on environmental measurements directly account for impact from multiple sources. Using environmental monitoring results as input for the dose assessment accounts for all sources of environmental contaminants, without the need for assumptions regarding the impacts of multiple facilities.

- Despite the lower concentrations in environmental media compared to effluent samples, adequate dose sensitivity can be achieved. Environmental sampling frequencies, sample sizes, and analytical methods have been selected to obtain sufficient sensitivity in order to support the required dose calculations.

The air pathway dose calculation, which is required to demonstrate compliance with EPA's NESHAP Subpart H standards, will also be based on monitoring data instead of effluent activities and subsequent air dispersion modeling.

As part of its integration responsibilities, the IEMP will serve to consolidate the FEMP's environmental monitoring, preventive tracking/feedback, and reporting requirements required to assess the air exposure pathway.

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C.3.3 Dose Calculation Procedure

C.3.3.1 Air Monitoring for NESHAP Subpart H Compliance

This section describes the technical approach for demonstrating compliance with NESHAP Subpart H using environmental measurements of radionuclide air concentrations at the FEMP fenceline. The section addresses each of the criteria for environmental measurement compliance programs as described in 40 CFR 61.93 (b)(5) and the basic requirements issued by EPA for NESHAP Subpart H environmental measurements at the FEMP.

Criterion (I): The air at the point of measurement shall be continuously sampled for collection of radionuclides.

Eighteen out of a network of 19 (16 fenceline, two background, and one for thorium tracking) continuously operating high volume air monitoring stations will be used for the collection of radionuclides. The air monitoring stations sample air at approximately 1 m3/minute using a 0.5 micron filter. The air monitoring stations contain a flow rate chart recorder and an hour-meter that provides a record of the monitors operation over the sampling period. The air monitoring stations are routinely checked to ensure normal operation. Figure 6-1 identifies the location of the air monitoring stations. Monitoring locations have been selected based on wind rose sectors and potential receptor locations.

Criterion (II): Those radionuclides released from the facility, which are the major contributors to the effective dose equivalent, must be collected and measured as part of the environmental measurement program.

The IEMP air monitoring program consists of the following sampling and analytical regime.

- Table C-1 identifies what biweekly samples will be collected from each air monitoring station. The constituents will be analyzed at analytical support level (ASL) B by the on-site laboratory.

TABLE C-1

BIWEEKLY ANALYSIS REGIME

Constituent	Method	HAMDC[a] (pCi/m^3)
Total Particulate	Gravimetric	-
Total Uranium	Laser Phosphorescence	3E-05
Thorium-228	Alpha Spec.	7E-06
Thorium-230	Alpha Spec.	7E-06
Thorium-232	Alpha Spec.	7E-06

- Quarterly composite samples will be prepared from the biweekly samples for each monitor. The composite samples will be analyzed at ASL E by an off-site laboratory for the following constituents of concern. Table C-2 provides the basis for the frequency of analysis and selection of constituents.

TABLE C-2

QUARTERLY ANALYSIS REGIME

Constituent	Method	HAMDC[a] (pCi/m^3)	HAMDC as Percent of Appendix E, Table 2 Values
Uranium-238	Alpha Spec.	9E-05	1.1
Uranium-234	Alpha Spec.	9E-05	1.3
Uranium-235/236	Alpha Spec.	9E-05	1.2
Thorium-228	Alpha Spec.	7E-06	0.2
Thorium-230	Alpha Spec.	7E-06	0.2
Thorium-232	Alpha Spec.	7E-06	1.1
Radium-226	Gamma Spec./Alpha Analysis	2E-04	6.1

[a]HAMDC = Highest Allowable Minimum Detectable Concentration as specified in the Sitewide Comprehensive Environmental Response, Compensation, and Liability Act Quality Assurance Project Plan (SCQ) (DOE 1998) or as specified in analytical contracts with off-site laboratories. The HAMDCs required by the FEMP provide adequate sensitivity to detect below 10 percent of the corresponding NESHAP standard for each radionuclide of interest.

Frequency of Analysis

Quarterly analysis of composite samples is performed in order to meet the following needs of the IEMP air monitoring program:

- Sufficient air sample volumes to detect the (very) low concentrations of contaminants in the air
- Periodic confirmation that contaminant concentrations are below the levels which would cause a dose of 10 mrem/year.

At low concentrations, large volumes of air must be sampled in order to readily detect and distinguish the presence of a contaminant from both the background and blank concentrations. Because filter loading limits the volume of air that can be sampled with a single filter, composite sampling is used to create a sample that represents a large volume of air.

Periodic (quarterly) measurements provide a means to check the concentrations of contaminants several times during the year. Activities or work practices will be adjusted if quarterly measurements indicate that the 10 mrem/year limit might be exceeded.

Quarterly Composite Analytical Suite

The isotopes selected for quarterly analysis represent the major contributors to dose based on the following considerations:

- Radionuclides which are stored in large quantities at the FEMP and which will be handled or processed during the remediation effort (uranium, thorium-232, thorium-230, and radium-226)

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- Radionuclides which have been the major contributors to dose based on environmental and stack filter measurements (uranium and thorium-230)

- Radionuclides, which due to their concentration in waste and contaminated soil, will be the major contributors to dose if the waste or soil is released in the form of fugitive dust (uranium, thorium-228, and thorium-230).

The large quantities of uranium and thorium compounds stored at the FEMP combined with the potential for release during the remediation effort are the basis for including them as major contributors to dose. The waste products from the chemical processes used to produce uranium metal at the FEMP, contain comparatively high levels of thorium-230 and radium-226. These wastes were either stored in the K-65 Silos (historically with the intent of recovering the radium-226) or disposed of in the waste pits. The high concentrations of thorium-230 in the waste pit material are documented in the Remedial Investigation Report for Operable Unit 1 (DOE 1994). The K-65 Silos contents and the high levels of radium-226 and thorium-230 are characterized in the Remedial Investigation Report for Operable Unit 4 (DOE 1993). The inclusion of radium-226 and thorium-230 as major contributors is based, in part, on the quantity of wastes that contain high levels of these radionuclides.

Stack filter measurements during production and environmental measurements during both production and the pre-remediation period at the FEMP confirm that uranium is the major contributor to air inhalation dose. Thus, these measurements provide additional justification for its inclusion as a major contributor as well as the target analyte for biweekly sampling.

Based on planned activities and the radiological characteristics of materials (soil and waste) to be processed, uranium and thorium-230 are expected to be the major contributors to the air pathway dose during the near term (2001 and 2002). However, DOE recognizes that as the remediation progresses, new sources of emissions may change the mix of major contributors. The potential to change the list of major contributors exists through the excavation of the waste pits and, to a lesser extent, the removal and handling of the silo's contents. The major contributors from these sources were estimated by calculating the radionuclides relative contributions to dose assuming resuspension of the pit material in the form of fugitive dusts. Average concentrations of pit materials (DOE 1994) were used to represent the radiological characteristics of the fugitive dusts. The radiological characteristics of the K-65 Silos were not used because the process to remove the silo contents is not expected to generate emissions in the form of fugitive dusts. Table C-3 lists the expected major contributors to dose during pit excavation.

Thorium-228 was added to the list of major contributors based on its greater than five percentage contribution from Pits 1, 2, and 4. Based on process knowledge, small quantities of transuranics (e.g., neptunium-237 and plutonium-239/240) and fission products (strontium-90, technetium-99, and cesium-137) shown in Table C-3 were introduced into the waste pits from recycled uranium and not from irradiated fuel. These radionuclides have been well characterized in the FEMP wastes and will not be major contributors to air inhalation dose.

TABLE C-3

PERCENTAGE CONTRIBUTION TO INHALATION DOSE ASSUMING RESUSPENSION OF WASTE PIT MATERIAL

Constituent	Pit 1	Pit 2	Pit 3	Pit 4	Pit 5	Pit 6
Cesium-137	0	0	0	0	0.2	0
Neptunium-237	0	0	0	0	3.4	0
Plutonium-238	0	0	0	0	0.1	0
Plutonium-239/240	0	0	0	0	0.3	0.1
Radium-226	1.1	4.8	2.9	0.3	3.4	0
Radium-228	0.2	1.1	1.2	0.4	0.5	0.2
Ruthenium-106	0	0	0	0	0	0
Strontium-90	0	2.0	0	0.1	0	0
Technetium-99	0	0	0.1	0	1.2	0
Thorium-228	5.2	6.1	2.8	7.4	0.7	0
Thorium-230	47.1	40.0	77.3	9.8	66.6	0.2
Thorium-232	16.2	9.1	8.4	9.5	2.5	0
Uranium-234	5.1	14.3	2.6	9.1	10	8.8
Uranium-235/236	0.7	6.6	.2	1.6	0.4	1.7
Uranium-238	24.4	16.1	4.6	61.7	10.7	88.9

DOE will monitor the changing mix of contributors by comparing the quarterly composite results to the NESHAP Appendix E, Table 2 values. If the fractions of the measured concentration to the corresponding NESHAP limit indicates a contaminant other than uranium is contributing the largest percentage of dose, then DOE will propose changes to the IEMP air monitoring and analytical schedule in order to better monitor the mix of major contributors.

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Consideration of Decay Chain Daughter Products

Uranium-238, thorium-232, and uranium-235 are initial radionuclides in the uranium, thorium, and actinide decay chains, respectively. Table C-4 shows the decay chains and the half-lives of the daughter products.

Note: Doses caused by radon-222 and its respective decay products formed after the radon is released from the facility are not included in the NESHAP dose limit of 10 mrem/year and will not be measured as part of the NESHAP Subpart H compliance demonstration. A description of the FEMP radon monitoring program is included in Section 6.0.

TABLE C-4

URANIUM, THORIUM, AND ACTINIDE DECAY CHAINS

Isotope	Half-Life	Isotope	Half-Life	Isotope	Half-Life
Uranium-238	4.5 x 10^{9} years	Thorium-232	1.4 x 10^{10} years	Uranium-235	7.1 x 10^{8} years
Thorium-234	24 days	Radium-228	5.7 years	Thorium-231	25.64 hours
Protactinium-234m	1.2 minutes	Actinium-228	6.13 hours	Protactinium-231	3.25 x 10^{4} years
Uranium-234	2.5 x 10^{5} years	Thorium-228	1.9 years	Actinium-227	21.6 years
Thorium-230	8.0 x 10^{4} years	Radium-224	3.64 days	Thorium-227	18.2 days
Radium-226	1622 years	Radon-220	55 seconds	Francium-223	22 minutes
Radon-222	3.8 days	Polonium-216	0.16 second	Radium-223	11.4 days
Polonium-218	3.05 minutes	Lead-212	10.6 hours	Radon-219	4.0 seconds
Lead-214	26.8 minutes	Bismuth-212	60.5 minutes	Polonium-215	1.77 x 10^{-3} seconds
Bismuth-214	19.7 minutes	Polonium-212	3.04 x 10^{-7} seconds	Lead-211	36.1 minutes
Polonium-214	1.6 x 10^{-4} sec.	Lead-208	Stable	Bismuth-211	2.16 minutes
Thallium-210	1.3 minutes			Thallium-207	4.79 minutes
Lead-210	22 years			Lead-207	Stable
Bismuth-210	5 days				
Polonium-210	138 days				
Lead-206	Stable				

The majority of uranium and thorium received and processed during the production era of the FEMP had been separated from its decay chain daughters prior to shipment to the FEMP. As a result, decay chain daughter products were not in equilibrium (the condition where the daughter concentration [in Curies per gram (Ci/g)] is equal to the parents' concentration [in Ci/g]) with the parent concentrations in the bulk of the materials received on site for processing.

Radioactive decay laws govern the ingrowth of the daughters from the purified parent. Daughter product ingrowth is based on the length of time the parent bearing material has been stored on site. As a general rule, the daughter of a long-lived parent (e.g., uranium-238, thorium-232, or uranium-235) grows into equilibrium with the parent in about 10 daughter half-lives. For example, using data from the above table, thorium-234 would reach equilibrium with uranium-238 in about 240 days (10 x 24 days).

Considering the half-lives in the table above and the 40-year production history of the FEMP, a number of daughters can conservatively be considered to be present in equilibrium concentrations with their parents. These radionuclides (thorium-234, radium-228, actinium-228, radium-224, and thorium-231) will be considered to be in equilibrium with their parent concentrations measured in the quarterly composite. The equilibrium based concentration for these radionuclides will be compared to the corresponding 40 CFR 61 Subpart H, Appendix E, Table 2 value as described in *Criterion IV*. Other radionuclides (protactinium-231, actinium-227, and their decay products) have not had sufficient time to reach equilibrium with their parent. In fact, due to the 32,500 year half-life of protactinium-231, none of the decay chain daughters have had time for significant ingrowth. Therefore, concentrations of decay chain daughters in the uranium-235 chain below thorium-231 will be considered to be zero in the quarterly composite samples.

Criterion (III): Radionuclide concentrations that would cause an effective dose equivalent of 10 percent of the standard shall be readily detectable and distinguishable from background.

As indicated in Table C-2, the detection limits for the major contributors to dose are less than 10 percent of NESHAP Appendix E, Table 2 values and will therefore be readily detectable, if present. The analysis of samples from the two background monitors will provide the data to distinguish fenceline and potential receptor monitoring results from background.

Criterion (IV): Net measured radionuclide concentrations shall be compared to the concentration levels in Table 2 of Appendix E to determine compliance with the standard. In the case of multiple radionuclides being released from the facility, compliance shall be demonstrated if the value for all radionuclides is less than the concentration level in Table 2, and the sum of the fractions that result when each measured concentration value is divided by the value in Table 2 for each radionuclide is less than one.

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Annual average radionuclide concentrations at each monitoring location will be determined for each radionuclide by dividing the sum of the radionuclide mass values, obtained via quarterly laboratory analysis, by the total volume of air drawn through the filter. As described above, decay chain daughter products will be assumed to be in equilibrium with the measured parent concentration. Concentrations will be corrected for background to obtain the net measured concentration. The resulting net annual average concentrations will be divided by the corresponding 40 CFR 61 Subpart H, Appendix E, Table 2 values. The resulting fractions will be summed per monitoring location to demonstrate compliance. Compliance with the Subpart H standard will be documented in a summary that will be submitted as part of IEMP annual integrated site environmental reports.

Managing Analytical Results

The analysis of environmental air samples may result in contaminant concentrations being reported at levels that are at or below the minimum detectable concentration (MDC). Contaminant concentrations, which are at or below MDC, are statistically indistinguishable from concentrations found in a blank sample. Air sample results which are reported at or below the MDC will therefore be considered non-detects (zero) for the purposes of demonstrating compliance with the NESHAP dose limit.

Detectable contaminant concentrations will be corrected to net detectable concentrations using the average background concentration measured during the same sampling period. Average background concentrations will be determined using the average detected concentrations at the two background air monitors. Background air monitoring results that are at or below MDCs will not be averaged, only measured concentrations will be used.

Criterion (V): A quality assurance program shall be conducted that meets the performance requirements described in Appendix B, Method 114.

All environmental sample collection and analysis conducted in support of the remediation effort at the FEMP are subject to the quality assurance requirements of the SCQ. This EPA approved plan and its incorporation into the IEMP sampling plan meets the quality assurance program requirements of Appendix B, Method 114.

Criterion (VI): Use of environmental measurements to demonstrate compliance with the standard is subject to prior approval by EPA. Applications for approval shall include a detailed description of the sampling and analytical methodology and show how the above criteria will be met.

The IEMP and its appendices provide a description of the sampling and analytical methodology and explains how the criteria will be met. DOE submitted an application to use environmental measurements to demonstrate compliance with the NESHAP Subpart H standard to EPA in May of 1997. EPA approved the application in August of 1997.

C.3.3.2 All Pathway Dose Calculations

This section describes the technical approach for demonstrating compliance with the 100 mrem/year all-pathway dose limit in DOE Order 5400.5. Estimates of annual dose are based on the measured, background-corrected concentration of a contaminant in each environmental media (i.e., groundwater and foodstuff). Ingestion rates for standard man are used for the consumption of water. A modified reference diet (Nuclear Regulatory Commission Reg. Guide 1.109) is used for the consumption of food. Dose conversion factors (DCF) (which are radionuclide specific factors used to convert a unit of ingested radioactivity [pCi] to dose [mrem]) are taken from DOE publications (Internal/External Dose Conversion Factors for Calculation of Dose to the Public DOE/EH-0070 and DOE/EH-0071).

The general form of the dose assessment equation is

$$D = C_{i,m} * I_m * DCF_i$$

where,

D = Dose (mrem/year)

$C_{i,m}$ = Background-corrected concentration of radionuclide I in media m (pCi/kg or pCi/L)

I_m = Intake (ingestion) rate for media (kg/year, or L/year)

DCF_i = Dose conversion factor for radionuclide I (mrem/year*pCi)

The detailed calculation of doses from the various environmental media was governed by FEMP procedure ADM-08, Estimating Radiological Pathway Dose. Doses from all the media monitored under the IEMP also will be calculated according to relevant sections in this procedure. In general, drinking water ingestion dose, foodstuff ingestion dose, air inhalation dose, and direct radiation dose will be separately calculated and then combined into the DOE all-pathway annual dose.

C.4 REPORTING

The types, frequency, and procedure of dose assessment reporting during FEMP remediation are summarized in this section. Based on the expanded objective of the dose assessment described in Section C.1, there will be three interfacing and reporting mechanisms in which the dose assessment results will need to be presented. Each of these three reporting processes is described in the following subsections.

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C.4.1 Project-Specific Interfaces

Remedial project-specific emission monitoring results collected by remediation projects for remedial workers health and safety concerns will be used to determine significant contributors among the on-going remedial actions. Therefore, an interface between the IEMP and ongoing remediation projects will be maintained in order to gather project-specific data and to provide feedback for adjusting/implementing source control measures. Frequency of data collection and evaluation will generally follow a quarterly reporting schedule unless project-specific considerations warrant special modifications.

C.4.2 Regulatory Interfaces

The IEMP air monitoring data will be posted to the IEMP Extranet Site. When the preventive tracking, based on quarterly monitoring data, indicates a need for adjusting/implementing project-specific source control measures, the regulatory agencies will be notified by the specific remediation projects. The modifications and the effectiveness of the improved source control measures will also be documented.

C.4.3 Annual Reporting

The NESHAP Subpart H Annual Report will be issued as part of IEMP annual integrated site environmental reports, according to reporting schedule in Section 8.0 of the IEMP. Annual summaries of the monitoring results, calculated doses from airborne emissions, calculated dose from eating foodstuffs produced near the FEMP, calculated direct radiation dose, and estimated dose from drinking well water will be included in the report. Comparisons of the pathway-specific and the combined annual radiological doses to the regulatory dose limits will also be presented.

C.5 SUMMARY

Figure C-1 shows the major tasks in the sitewide dose tracking and annual dose assessment processes during the FEMP remediation described in this Appendix. Table C-5 further summarizes the responsibilities of the IEMP and specific remediation projects to fully implement the sitewide air-pathway dose tracking and annual dose assessment processes.

TABLE C-5

SITEWIDE DOSE TRACKING AND ANNUAL ASSESSMENT TASKS

Tasks	Project Responsibilities
	IEMP
• Annual Sitewide Planning	Evaluate planned remediation activities and source conditions at beginning of the year
• Routine Fenceline Monitoring	Conduct routine air monitoring at background and fenceline locations
Preventive Tracking/Feedback	Directly compare routine monitoring results to annual dose benchmarks quarterly; report and evaluate any exceedances
NESHAP Compliance Demonstration	Based on actual monitoring data, calculate annual doses at monitoring locations
Reporting	Prepare quarterly summaries and the annual NESHAP report
	Remediation Project
Annual Planning	Specify project-specific remedial schedule and activities at beginning of the year
• Maintain Fugitive Dust and/or Emission Source Control	Maintain/improve effective fugitive dust and emission source control measures within the project boundary
• Health and Safety Monitoring	Conduct routine remedial worker health and safety monitoring

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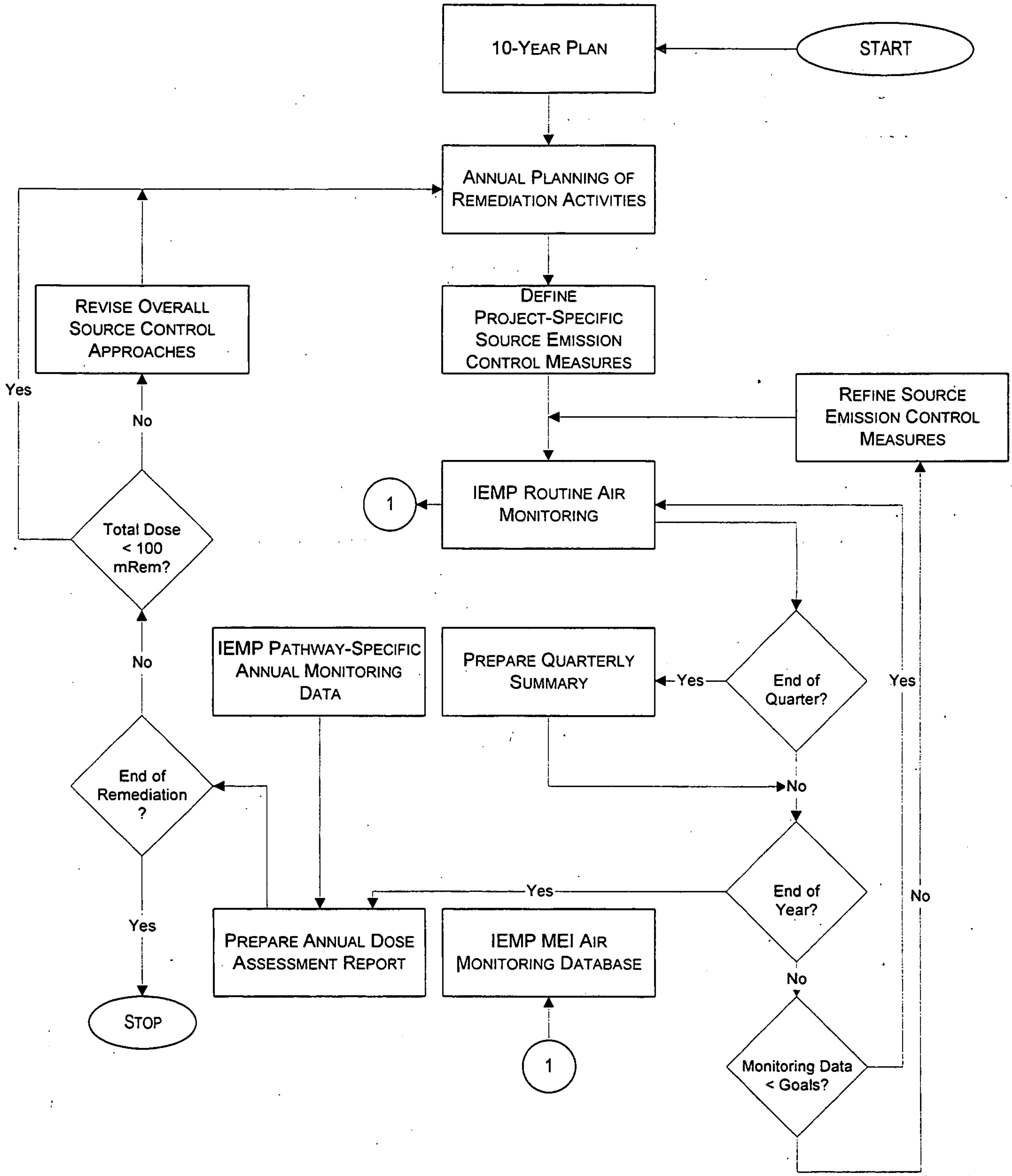
FIGURE C-1
SITEWIDE IEMP/DOSE TRACKING AND ASSESSMENT ROAD MAP



REFERENCES

U.S. Dept. of Energy, 1998, "Sitewide CERCLA Quality Assurance Project Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1994, "Remedial Investigation Report for Operable Unit 1", Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

U.S. Dept. of Energy, 1993, "Remedial Investigation Report for Operable Unit 4", Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Field Office, Cincinnati, OH.

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Appendix D

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APPENDIX D

NATURAL RESOURCE MONITORING PLAN

APPENDIX D

NATURAL RESOURCE MONITORING PLAN

D.1 INTRODUCTION AND OBJECTIVES

The purpose of the Natural Resource Monitoring Plan (NRMP) is to monitor the status of impacts to natural resources at the Fernald Environmental Management Project (FEMP) during remediation. In addition, the plan will outline an approach to monitor the status of several priority natural resource areas in order to remain in compliance with the appropriate regulations. The results of this monitoring will be used to inform the U.S. Environmental Protection Agency (EPA), Ohio Environmental Protection Agency (OEPA), and the Fernald Natural Resource Trustees as to the status of Fernald's natural resources. Reporting of the monitoring results will be integrated with the annual Integrated Environmental Monitoring Plan (IEMP) reporting schedule. The IEMP annual integrated site environmental reports will also summarize the results of monitoring ecological restoration efforts required through project-specific Natural Resource Restoration Design Plans.

D.2 ANALYSIS OF REGULATORY DRIVERS

As shown in Table D-1, regulatory drivers for the management of natural resources and associated impact monitoring include five areas: endangered species protection; wetlands/floodplain regulations; cultural resource management; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) natural resource trusteeship process; and the National Environmental Policy Act (NEPA).

TABLE D-1

FEMP NATURAL RESOURCE MONITORING

DRIVER	ACTION
Endangered Species Act Ohio Endangered Species Regulations	The IEMP describes management of existing habitat and future follow-up surveys.
Clean Water Act - Section 404	The IEMP describes the monitoring of mitigated wetlands.
National Historic Preservation Act Native American Graves Protection and Repatriation Act Archaeological Resources Protection Act	The IEMP describes the monitoring of cultural resources.
CERCLA Executive Order 12580 National Contingency Plan	The IEMP describes the CERCLA Natural Resources Trusteeship process.
NEPA	The IEMP discusses the substantive requirements of NEPA for protecting sensitive environmental resources.

D.2.1 Threatened and Endangered Species

The federal laws and regulations listed below mandate that any action authorized, funded, or carried out by the U.S. Department of Energy (DOE) cannot jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat. Additional requirements may apply if it is determined that a proposed activity could adversely affect these species or their habitat. These laws and regulations include the Endangered Species Act (16 United States Code [U.S.C.] §1531, et seq.) and its associated regulations (50 Code of Federal Regulations [CFR] 17 and 50 CFR 402).

State law also protects endangered species by prohibiting the taking or destruction of any state-listed endangered species. These laws are found in Ohio Revised Code §1518 and §1531, as well as in Ohio Administrative Code §1501.

D.2.2 Wetlands/Floodplains

Executive Order 11990 (Protection of Wetlands) and Executive Order 11988 (Protection of Floodplains), which are implemented by DOE Regulation 10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements," specify the requirement for a Floodplain/Wetland Assessment in cases where DOE is responsible for providing federally undertaken, financed, or assisted construction and improvements that may impact floodplains or wetlands. This regulation further requires that DOE exercise leadership to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands.

Pursuant to Section 404 of the Clean Water Act and 33 CFR § 323.3, any activity that results in the discharge of dredged or fill material out of or into a wetland or water of the United States requires permit authorization by the Army Corps of Engineers. These permits can be in the form of either nationwide permits (33 CFR Part 330) or individual permits (33 CFR Part 323) depending on the nature of the activity.

Section 401 of the Clean Water Act and 33 CFR §325.2(b)(1)(ii), also require that a Section 401 State Water Quality Certification be obtained to authorize discharges of dredged and fill material under a Section 401 permit. In Ohio, the Section 401 State Water Quality Certification program is administered by OEPA pursuant to Chapter 3745-32 of the Ohio Administrative Code.

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D.2.3 Cultural Resource Management

Management of cultural resources, particularly archeological sites, is mandated by the National Historic Preservation Act (16 U.S.C. §470), the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001, et seq.), and the Archeological Resources Protection Act (16 U.S.C. §470aa-470ll). The associated regulations for the above laws are found in 36 CFR 800, 43 CFR 10, and 43 CFR 7, respectively. These laws and associated regulations ensure that archeological resources on federal land are appropriately managed. Section 106 of National Historic Preservation Act ensures that DOE takes into consideration the effect of its undertakings on properties eligible for listing on the National Register of Historic Places, and that the Advisory Council on Historic Preservation has an opportunity to comment on those effects. Native American Graves Protection and Repatriation Act and 43 CFR 10 require that the rightful control of Native American cultural items that are discovered on federal land be relinquished to the appropriate, culturally affiliated tribe(s). Federal land is defined as "land that is owned or controlled by a federal agency" (e.g., the FEMP). Cultural items are defined as "human remains, associated funerary objects, unassociated funerary objects, sacred objects, and objects of cultural patrimony." Archeological Resources Protection Act and 43 CFR 7 ensure that competent individuals carry out archeological excavations in a scientific manner.

DOE has finalized a Programmatic Agreement with the Advisory Council on Historic Preservation and the Ohio Historic Preservation Office that streamlines the National Historic Preservation Act Section 106 consultation process. Monitoring provisions will be included as part of this agreement to ensure that appropriate management is implemented for any eligible properties at the FEMP.

D.2.4 The CERCLA Natural Resource Trusteeship Process

CERCLA, Executive Order 12580, and the National Contingency Plan collectively require certain federal and state officials to act on behalf of the public as trustees for natural resources. Trustees for the FEMP are the Secretary of DOE; the Secretary of the U.S. Department of the Interior; and officials of the OEPA, appointed by the Governor of Ohio.

The trustees' role is to act as guardians for public natural resources at or near the FEMP. The trustees are responsible for determining if natural resources have been injured as a result of a release of a hazardous substance or oil spill from the site and if so, how to restore, replace, or acquire the equivalent natural resources to compensate for the injury. DOE, as the responsible party, is responsible for costs related to natural resource injury, in addition to costs associated with remediation of the site.

The Fernald Natural Resource Trustees have been meeting since June of 1994 to evaluate and determine the feasibility of integrating the trustees' concerns with future remediation activities. The trustees have identified their desire to resolve DOE's liability by integrating restoration activities with remediation.

The Fernald Natural Resource Trustees have chosen to focus on a restoration-based approach to resolve DOE's liability for natural resource impacts. To accomplish this, the Fernald Natural Resource Trustees are collectively developing a Memorandum of Understanding that establishes implementation of a Natural Resource Restoration Plan (NRRP) as the primary means of settlement for an existing natural resource damage claim against DOE by OEPA. The NRRP sets forth a conceptual design for a series of ecological restoration projects that will eventually encompass approximately 850 acres of the FEMP site. Detailed designs will be generated through Natural Resource Restoration Design Plans. Results of NRMP monitoring will be taken into consideration during the design of these area-specific restoration projects. Natural Resource Restoration Design Plans will have project-specific monitoring requirements to determine the success of the restoration project. As stated in Section D.1, this monitoring will be summarized and reported through IEMP reporting.

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In April 1998 the Fernald Natural Resource Trustees (including OEPA) tentatively agreed that reporting associated with natural resources would be provided in annual IEMP integrated site environmental reports and through correspondence between DOE and the Fernald Natural Resource Trustees. It was also agreed that quantitative monitoring of impacted habitats associated with natural resources will not be necessary because the proposed settlement identifies that natural resource restoration will be performed for all on-property areas outside the on-site disposal facility, the Operable Unit 4 supplemental projects, and the area under consideration by the Community Reuse Organization for economic development.

D.2.5 National Environmental Policy Act

In addition to the specific regulatory drivers summarized above, aspects of natural resource management and monitoring are mandated through the incorporation of substantive NEPA requirements into remedial action planning. In June 1994 DOE issued a revised secretarial policy on NEPA compliance. This policy called for the integration of NEPA requirements into the CERCLA decision-making process. Therefore, requirements for the protection of sensitive environmental resources including threatened and endangered species and cultural resources are to be considered throughout remediation activities.

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D.3 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

The expectations of the monitoring and reporting as outlined in the NRMP are as follows:

- Provide a mechanism to monitor the status of Fernald's natural resources to remain in compliance with applicable laws and regulations
- Support the design of area-specific restoration projects as conceptually described in the NRRP.

The results of the monitoring outlined in this NRMP may have an impact on design issues associated with the NRRP. If the amount of impact to natural resources during remediation activities is substantially more or less than anticipated in the Natural Resource Impact Assessment, then adjustments to the amount of natural resource restoration activities as outlined in the NRRP may be warranted. In addition, if impacts to a sensitive area were to occur during remediation that was not anticipated (i.e., the northern-forested wetland), then additional activities (e.g., wetland mitigation) may be required. It is not anticipated that results of the NRMP will impact any other aspect of remedial design.

D.4 NATURAL RESOURCE MONITORING PLAN

Monitoring will be implemented during remediation activities to identify impacts to natural resources at the FEMP with particular emphasis placed on meeting regulatory requirements for NEPA, threatened and endangered species, wetlands/floodplains, and cultural resources. To accommodate natural resource monitoring, priority natural resource areas have been established across the FEMP (Figure D-1). FEMP personnel will carry out all natural resource monitoring, with oversight from DOE-Fernald.

Outside expertise may be used in limited circumstances depending on the type of monitoring to be conducted. A description of the monitoring strategies to be implemented at the FEMP is provided below.

D.4.1 Threatened and Endangered Species

The state-listed threatened Sloan's crayfish (*Orconectes sloanii*) and the federally endangered Indiana brown bat (*Myotis sodalis*) are the only threatened or endangered species to have a known population at the FEMP. However, there is the potential for other state- and federally listed threatened and endangered species to have habitat ranges that encompass and/or occupy the FEMP. Therefore, monitoring will continue to track the status of the Sloan's crayfish and Indiana brown bat populations and their habitats as well as several other listed species that potentially could use the FEMP.

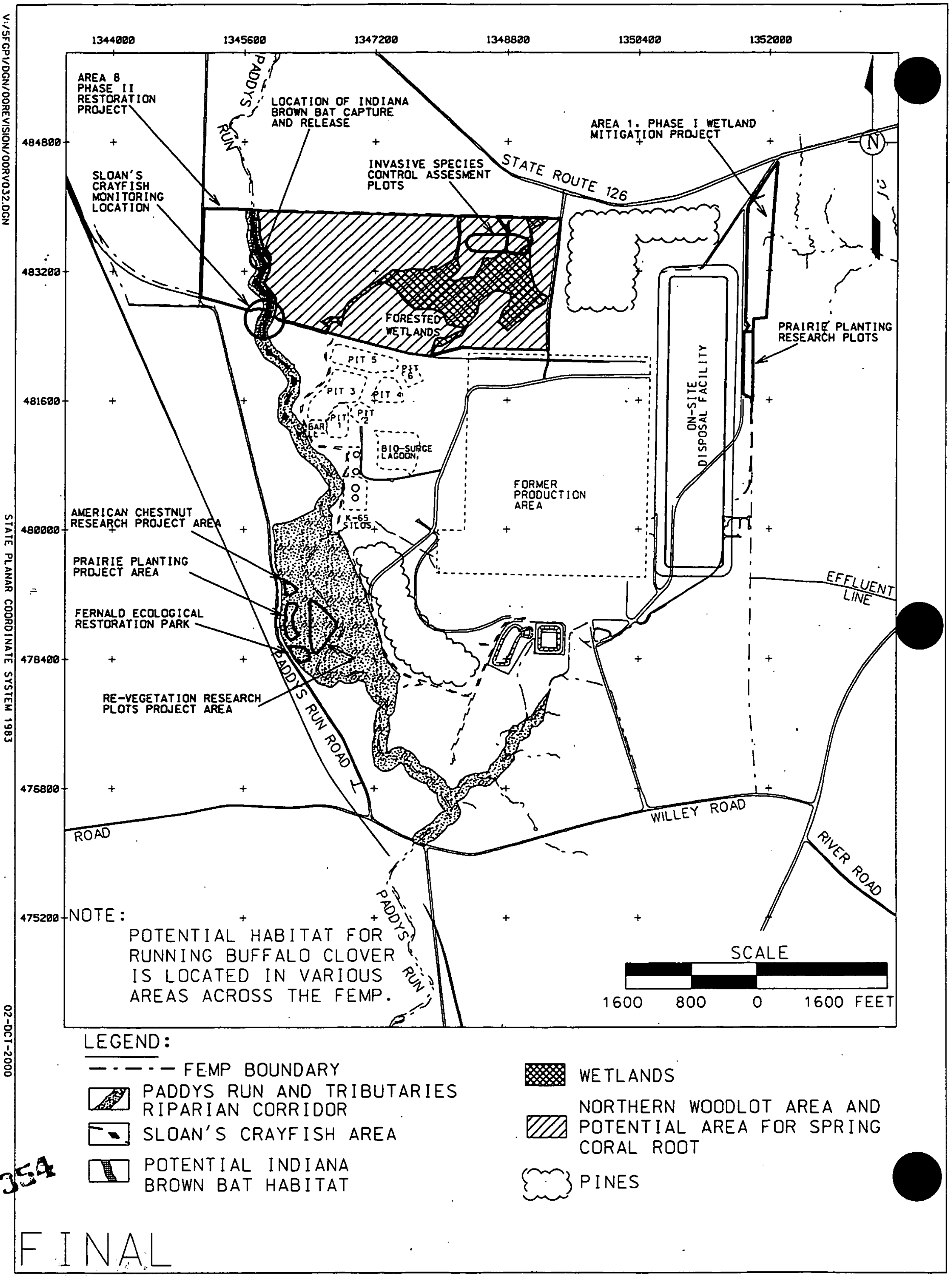

FIGURE D-1. PRIORITY NATURAL RESOURCE AREAS

D.4.1.1 Sloan's Crayfish

The state-listed threatened Sloan's crayfish is a small crayfish found in the streams of southwest Ohio and southeast Indiana. It prefers streams with constant (though not necessarily fast) current flowing over rocky bottoms. A large, well-established population of Sloan's crayfish is found at the FEMP in the northern reaches of Paddys Run. In dry periods, the crayfish retreat to deeper pools that remain both downstream and upstream of the train trestle. A significant population of Sloan's crayfish also resides in an off-property section of Paddys Run at New Haven Road. The Sloan's Crayfish Management Plan, which is included as Attachment D.1 to this appendix, provides additional information on the FEMP Sloan's crayfish population.

This species resides with one other competing species of crayfish (*Orconectes rusticus*) that is generally considered more aggressive. In addition, the Sloan's crayfish is sensitive to siltation in streams.

Impacts to Sloan's crayfish are similar to impacts to other aquatic organisms in Paddys Run. Impacts of concern would include excavation and alteration of the streambed along with increased siltation and runoff into Paddys Run. Visual field observations after every storm event were conducted from August of 1996 through December of 1997 to identify any impact of sediment loading on the Sloan's crayfish population in Paddys Run from FEMP activities. As a result of those visual field observations, no impact was observed due to sediment loading to Paddys Run. These observations support the finding that existing storm water controls are adequate for addressing potential impacts to Sloan's crayfish habitat due to sediment loading.

EPA and OEPA agreed with DOE to cease visual observations of sediment loading to Paddys Run until either: 1) significant soil disturbances occur in the drainage area discharging to Paddys Run via the northern drainage ditch; or 2) storm water control inspections indicate that sediment controls are not properly functioning. Visual observations of Sloan's crayfish populations were resumed when construction activities began in the vicinity of the waste storage area. In general, site activities have not impacted the Paddys Run crayfish population. However, on several occasions an elevated amount of sediment runoff was observed in the northern drainage ditch following rain events. Because the instances were of short duration (less than 24 hours), no impacts to the Sloan's crayfish occurred. The source of the elevated sediment has been traced to the rail yard sedimentation basin. Several corrective measures were implemented, including repair of eroding fill around an inlet pipe and seeding of exposed soil. DOE will continue to monitor the northern drainage ditch following rain events in order to determine the effectiveness of these corrective actions.

Additionally, as a condition of the FEMP National Pollutant Discharge Elimination System Permit, visual observations of sediment controls must be carried out pursuant to the FEMP's Storm Water Pollution Prevention Plan on a weekly basis and after any storm event. A storm event is defined as being "any event in which more than 0.5 inch of rainfall occurs in a 24-hour period." An inspection form is completed after each visual observation to ensure that sediment controls are properly functioning. FEMP natural resource personnel will interface with the personnel conducting the visual observations of sediment controls on a regular basis to ensure controls remain in place.

The Sloan's crayfish population in Paddys Run will be surveyed every three years to monitor trends in the long-term status of the population. A survey in the fall of 1999 revealed a significant population of Sloan's crayfish in Paddys Run. The survey involved the use of nets to capture and identify species in Paddys Run. The next survey will be conducted in 2002.

The attached Sloan's Crayfish Management Plan describes in greater detail the requirements listed above. A contingency plan is also included which calls for the upstream relocation of affected crayfish populations, if necessary. Relocation of crayfish populations is not anticipated. However, relocation is an option if remedial activities would result in severe degradation of existing habitat in Paddys Run.

D.4.1.2 Indiana Brown Bat

Good to excellent habitat for the federally listed endangered Indiana brown bat (*Myotis sodalis*) has been identified north of the train trestle in Paddys Run. The habitat provides an extensive mature canopy from older trees and the presence of water throughout the year. In 1999, one adult female was captured and released along Paddys Run. Potential impacts to Indiana brown bat habitat include soil excavation and tree removal associated with soil and/or stream remediation and alteration along riparian areas in the northern on-property sections of Paddys Run. Because the bats use loose-bark trees for their maternal colonies, removal of trees would impact this species by eliminating its summer habitat.

Remediation activities are not currently planned within the area of concern for the Indiana brown bat. The habitat of the Indiana brown bat will be monitored during remediation activities as part of the program outlined in Section 4.4 to identify any unanticipated impacts during remediation. However, if remediation activities are proposed as a result of certification sampling identifying unanticipated hot spots of contamination in the Paddys Run area north of the train trestle, then a follow-up survey for the Indiana brown bat will be initiated prior to initiation of remediation activities. In addition, a survey will be conducted before ecological restoration activities are conducted. Follow-up surveys may also be proposed as part of success monitoring in the NRRP if that area is considered for enhancement of the Indiana brown bat population.

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If monitoring is determined appropriate, then monitoring methods for the Indiana brown bat would consist of mistnetting in areas suitable as bat flyways and where canopy occurs. Mistnetting would occur between May 15 and August 15, since some bats begin to disperse for winter shelter in late August. Data recorded at each sampling site would include type of habitat, water depth and permanence, type of bottom, tree species and size, and presence of hollow trees or trees with loose bark in the vicinity. In addition to mistnets, bat detectors would be used during all sampling to detect echolocation calls near the net, which indicate bat activity. The number of calls on the detector would be recorded to indicate the effectiveness of the nets in relation to bat activity. Bat detectors can also be used to sample areas of marginal habitat to determine if netting should be attempted.

D.4.1.3 Running Buffalo Clover

The federally listed endangered running buffalo clover (*Trifolium stoloniferum*) surveys conducted in 1994 found no individuals of this species at the FEMP. However, because running buffalo clover is found nearby in the Miami Whitewater Forest, the potential exists for this species to establish at the FEMP. The running buffalo clover prefers habitat with well-drained soil, filtered sunlight, limited competition from other plants, and periodic disturbance. Therefore, surveys will be conducted in future years, as needed, prior to remediation activities within areas of concern for running buffalo clover. Areas of concern at the FEMP are limited, but would include partially shaded and sparsely vegetated areas along Paddys Run and the Storm Sewer Outfall Ditch. Follow-up surveys would optimally be conducted between May and June, which is the time frame for blooms. An appropriate number of transects would be walked in suspect areas to identify the running buffalo clover. This plant is a perennial that forms long stolons, rooting at the nodes. The plant is also characterized by erect flowering stems, typically three to six inches tall, with two leaves near the summit topped by a round flower head. If populations are discovered, then best management practices would be utilized to minimize impacts and the NRRP would be adjusted accordingly.

The U.S. Fish and Wildlife Service has recently announced plans to delist running buffalo clover from its endangered status. However, the plant would still require monitoring because of its status as an endangered species in the State of Ohio.

D.4.1.4 Spring Coral Root

The state-listed threatened spring coral root (*Corallorhiza wisteriana*) is a white and red orchid which blooms in April and May and grows in partially shaded areas of mesic deciduous woods, such as forested wetlands and wooded ravines. Although surveys conducted in 1994 and 1995 indicated no individuals were present, suitable habitat exists in portions of the northern woodlot.

A floristic analysis for the northern woodlot and associated northern-forested wetland was conducted in 1998. This analysis showed that no spring coral root was present in the northern woodlot.

D.4.2 Floodplains/Wetlands

Approximately 10 acres of on-property wetlands adjacent to the former production area will be impacted as a result of contaminated soil excavation. The 26-acre northern-forested wetland area and associated drainage characteristics will be avoided and protected during remediation activities. A mitigation ratio of 1.5:1 (1.5 acres of wetlands will be replaced for every one acre of wetland disturbance) was negotiated between DOE and the appropriate agencies (EPA, OEPA, U.S. Fish and Wildlife Service, and Ohio Department of Natural Resources). As a result of this agreement, 16.5 acres of wetlands must be established to compensate for the impacts during remediation. DOE does not expect additional wetland delineations as all naturally created wetlands on the site have been identified. It is possible that as a result of remediation activities, areas of poor drainage will be created and some wetland vegetation may emerge. Because these areas could be temporary, and their creation inadvertent, they would not be delineated as wetlands.

Wetland mitigation was initiated at the FEMP in 1999. Approximately six acres of wetlands were constructed within a 12-acre ecological restoration project along the North Access Road. Details of mitigation monitoring will be reported separately from IEMP reporting. Narrative summaries will be provided in IEMP annual integrated site environmental reports.

D.4.3 Cultural Resource Management

All field personnel must comply with procedure EP-0003, Unexpected Discovery of Cultural Resources, if cultural resources are uncovered during ground disturbing activities. Monitoring will occur on a limited basis in all areas that have been surveyed to identify any unexpected discoveries of human remains (Figure D-2). More intensive field monitoring will only take place in areas known to have a high potential for archaeological sites as determined by previously conducted investigations. In most instances, discovery of human remains will require data recovery work in previously surveyed areas. Any disturbance of previously unsurveyed areas will require at least Phase I investigations. An annual summary of all cultural resource field activities is separately provided from the IEMP under the Programmatic Agreement for Archeological Activities at the Fernald Site.

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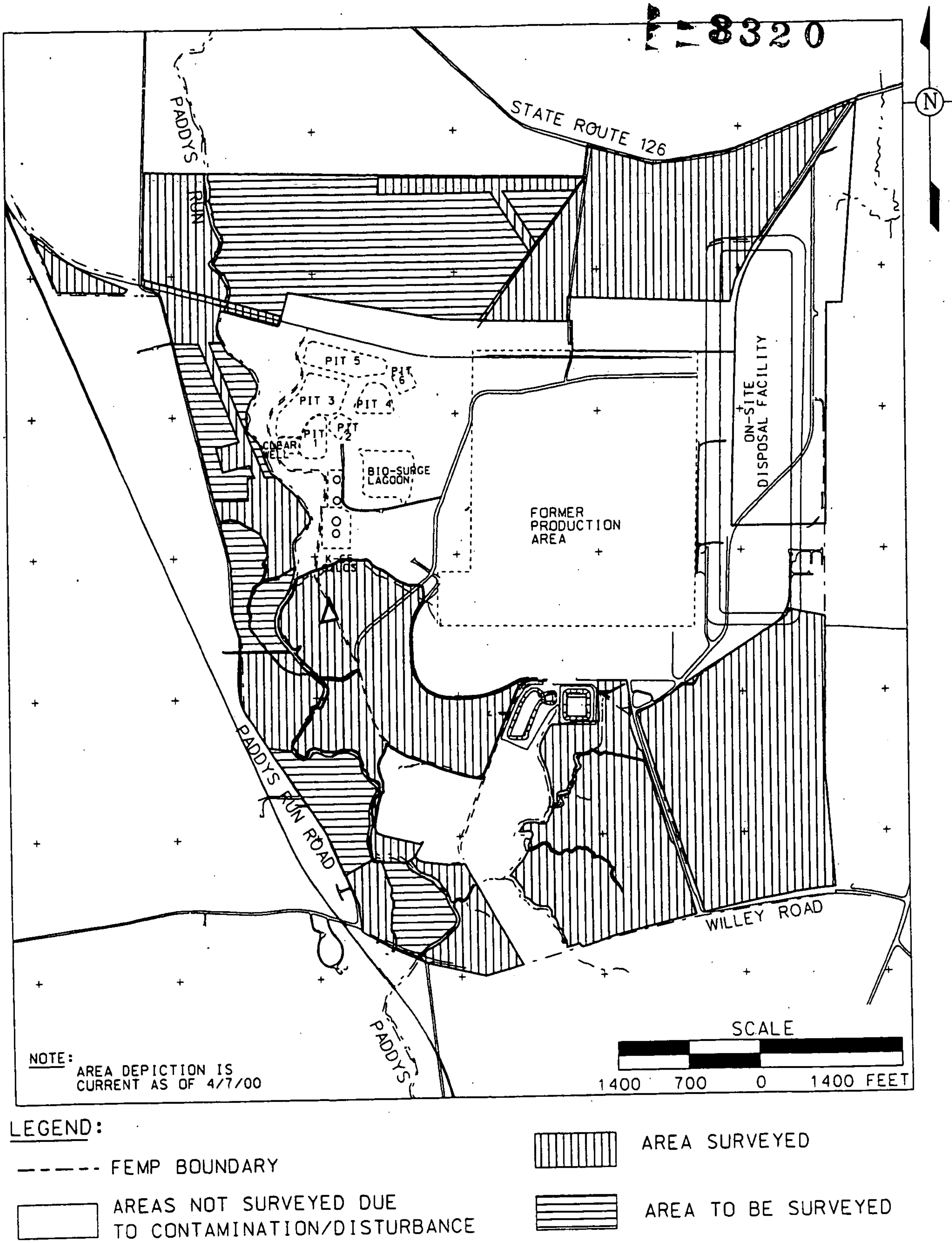

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FIGURE D-2. CULTURAL RESOURCE SURVEY AREAS

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D.4.4 Habitat Monitoring

As stated in Section D.2.4, the Natural Resource Trustees have tentatively agreed that habitat impact monitoring is not necessary. If renegotiations with the trustees become necessary, then quantitative quarterly habitat impact tracking may be resumed. A narrative summary of habitat impacts will be provided in IEMP annual integrated site environmental reports.

D.4.5 Natural Resource Data Evaluation and Reporting

The results of natural resource monitoring will be integrated with the annual reporting committed to in the IEMP. Table D-2 provides a summary of the monitoring activities to be carried out until the end of 2002 (i.e., the life of this version of the IEMP). IEMP annual integrated site environmental reports will provide appropriate updates on unexpected impacts to natural resources and the results of specific natural resource monitoring that has been implemented (i.e., crayfish, cultural resources, etc.). Due to the effort to streamline the quarterly reporting, Natural Resources monitoring will not be included in the quarterly summaries. However, significant findings will still be communicated to the regulatory agencies on an as-needed basis by the Natural Resources Project.

TABLE D-2

SUMMARY OF MONITORING ACTIVITIES FOR 2001 AND 2002

Monitoring Activity	Implementation
Sloan's crayfish	2001 and 2002
Sloan's crayfish population summary	2002
Cultural resources	2001 and 2002
Delineation of additional wetlands	As required
Follow-Up Threatened and Endangered Species Surveys	As required

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ATTACHMENT D.1

SLOAN'S CRAYFISH MANAGEMENT PLAN

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ATTACHMENT D.1

SLOAN'S CRAYFISH MANAGEMENT PLAN

D.1.1 Introduction

The purpose of this plan is to provide a management strategy for the state-threatened Sloan's crayfish *(Orconectes sloanii)* and its associated habitat at the Fernald Environmental Management Project (FEMP). Remedial work at the FEMP has the potential to result in increased sediment loading to Paddys Run in the area inhabited by the Sloan's crayfish. Therefore, the U.S. Department of Energy (DOE) has prepared a management plan to meet the intent of state and federal regulations governing the management of threatened and endangered species and to fulfill the DOE's role as a Natural Resource Trustee.

D.1.2 Background

The Sloan's crayfish has been listed as threatened in the state of Ohio. Populations of the Sloan's crayfish are known to reside only in southeastern Indiana and southwestern Ohio (St. John 1993). The Sloan's crayfish resides in streams with constant flow and flat, rocky bottoms covered with broken or rounded stones. A decline in the species has been noted in streams that have been effected by urbanization, construction, and other forms of human stress. Crayfish breathe through gills; therefore, increases in sediment loading in streams they inhabit will decrease their chances for survival.

The species was discovered in the northern portion of Paddys Run at the FEMP (Figure D.1-1) during surveys conducted by Dr. F. Lee St. John in September 1993 and May 1994. The surveys for the crayfish were amongst several conducted at the site during that time frame. Remediation of the FEMP is being undertaken pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and will involve the excavation of large portions of the site and the construction of new treatment and disposal facilities. The Sloan's crayfish has been identified as a species that requires special consideration during the planning and implementation of remediation activities at the FEMP.

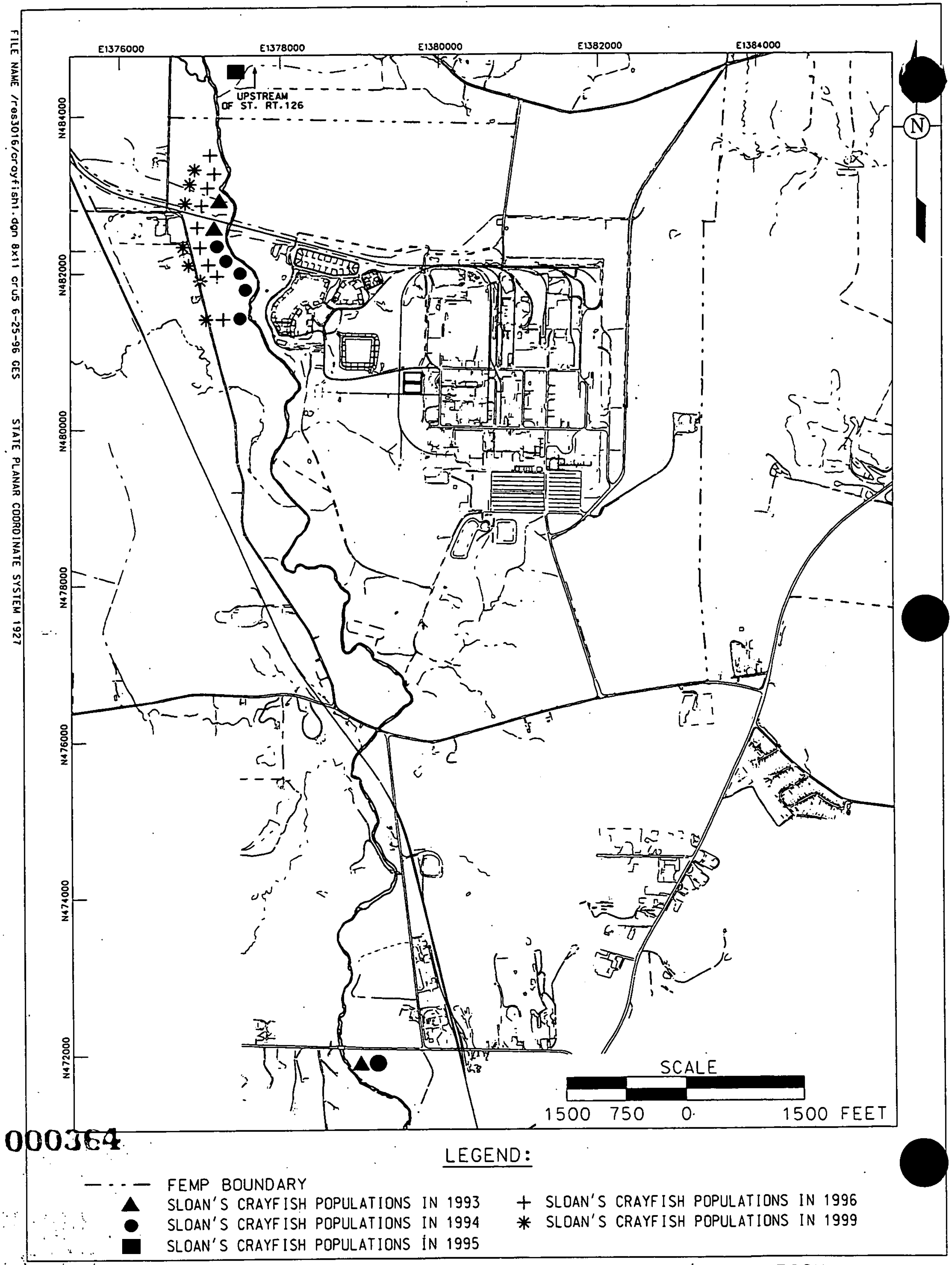

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FIGURE D.1-1. SURVEY RESULTS FOR SLOAN'S CRAYFISH

D.1.3 Management Objectives

The primary objective in managing the Sloan's crayfish population at the FEMP is to ensure that adequate habitat is available within Paddys Run for the continued existence of the population upon completion of remediation. This will be accomplished through preservation and/or post-remedial restoration. In addition, efforts to protect the current population from degradation during remediation activities will also be employed to the extent practicable. As discussed in greater detail below, the combination of adequate controls to minimize sediment loading remediation activities, coupled with the availability of a "refuge area" for the crayfish population upstream, will minimize short-term degradation to the crayfish population. In addition, field monitoring will be initiated to identify potential impacts to the portions of Paddys Run containing the population. If it is determined that impacts to the stream may result in the long-term degradation of the population, then DOE will notify the appropriate agencies and relocate individual crayfish.

The objectives of this management plan are to undertake all measures practicable to protect the species within Paddys Run and to minimize stress to the species by relocating only if necessary. DOE feels the most important aspect of the management plan is to ensure that an optimal habitat exists for the crayfish in the long-term (i.e., postremediation). This would be accomplished either through preserving and/or enhancing existing habitat or restoring habitat if the existing habitat is impacted during remediation. Future FEMP remediation activities may also involve excavation activities that will potentially impact the population. Therefore, this plan of action may be incorporated by reference into future work plans.

D.2 MANAGEMENT PLAN

There are three phases to the protection of the Sloan's crayfish and its associated habitat within Paddys Run. The first two phases are avoidance measures while the last phase is a mitigation effort. First, several controls will be installed to prevent excessive sedimentation into Paddys Run. Second, the area of Paddys Run upstream of the train trestle and the confluence of the northern drainage ditch will be preserved as a refuge for Sloan's crayfish to the maximum extent practicable (Figure D.1-2). The third aspect of protection is the mitigation of appropriate habitat, if required, after remediation activities have been completed. All three phases of Sloan's crayfish protection are discussed in more detail below.

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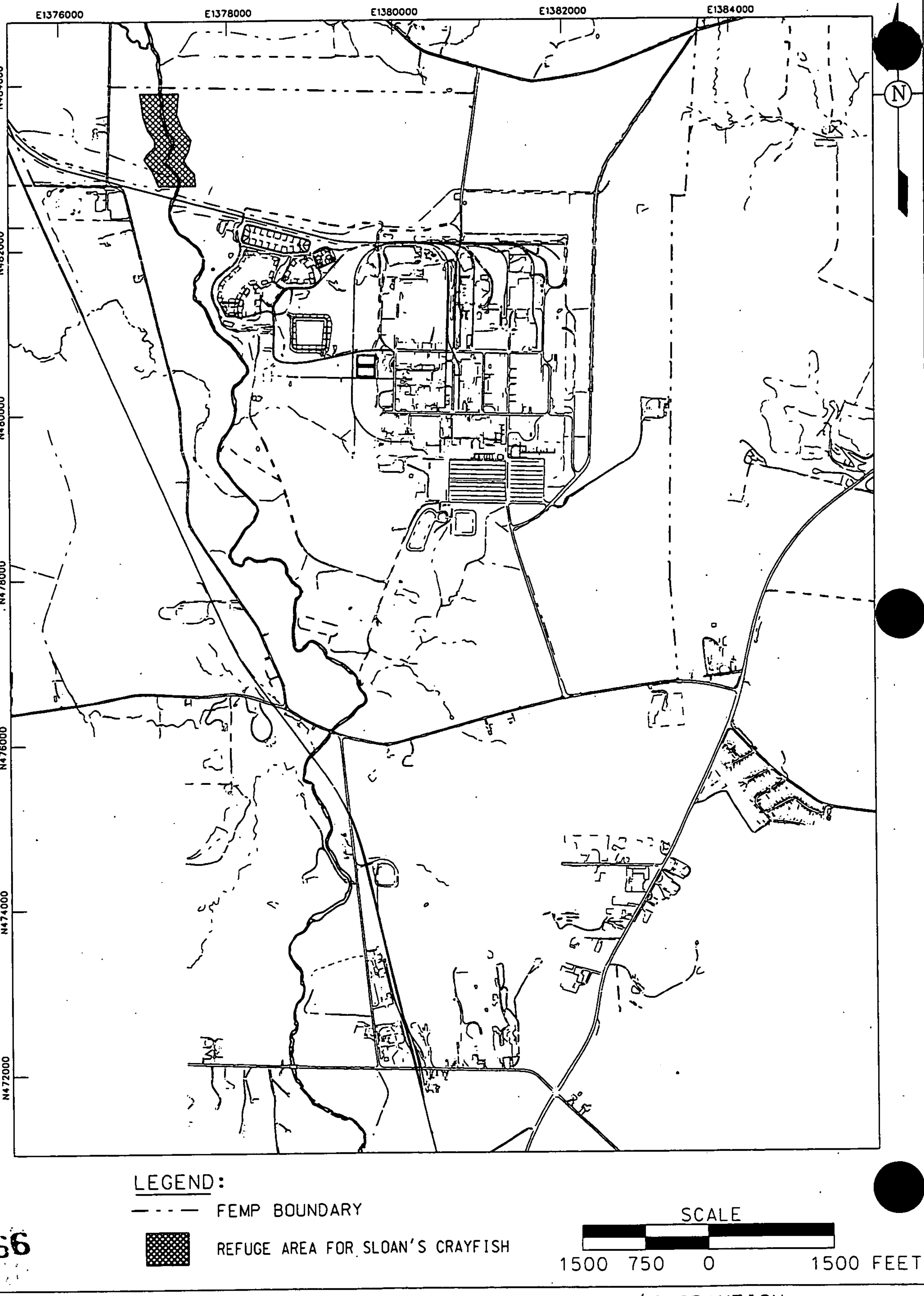

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FIGURE D.1-2. REFUGE AREA FOR SLOAN'S CRAYFISH

D.2.1 Sedimentation Controls

The primary source of surface water runoff from the FEMP to the Sloan's crayfish habitat in Paddys Run is from the westerly flowing drainage area directly located north of the railroad tracks on the northern side of the former production area. The confluence of this drainage area and Paddys Run is a National Pollutant Discharge Elimination System (NPDES) permitted storm water outfall (STRM 4006) and is subject to semiannual monitoring under the terms and conditions of the new site NPDES Permit (Ohio Environmental Protection Agency [OEPA] Permit No. 1IO00004*FD). This ditch was also identified as a jurisdictional wetland during the 1993 delineation of the site.

Large scale earthmoving activities associated with the Operable Unit 1, Operable Unit 2, and Operable Unit 5 Remedial Actions are planned within several watershed basins in the northern and eastern portions of the site that ultimately drain to Paddys Run through the northern drainage ditch described above. Erosion control devices will conform to the requirements of the site NPDES Permit, the FEMP Storm Water Pollution Prevention Plan (SWPPP, PL-3083), and various applicable or relevant and appropriate requirements identified in the Operable Unit 1, Operable Unit 2, and Operable Unit 5 Records of Decision. Specifications for sedimentation and erosion control devices are being incorporated into the remedial design packages for these activities in an effort to avoid and/or minimize erosion and sedimentation to the northern drainage ditch and Paddys Run. As part of CERCLA Remedial Design packages for Operable Unit 1, Operable Unit 2, and Operable Unit 5, these erosion and sedimentation designs are subject to review and approval by the U.S. Environmental Protection Agency (EPA) and OEPA. Once established in the field, DOE will inspect these controls, at a minimum, on a weekly basis to ensure their effectiveness in accordance with the requirements of the SWPPP. Given that the extensive erosion and sedimentation controls described above will be established, adverse impacts to Sloan's crayfish habitat in Paddys Run will be avoided and minimized to the maximum extent practicable.

D.2.2 Refuge Preservation

The area of Paddys Run immediately north of the train trestle and the confluence of the northern drainage ditch to the FEMP property line will be preserved as a refuge for Sloan's crayfish to the maximum extent practicable (Figure D.1-2). Appropriate habitat exists in this area, as evidenced by several studies that have identified Sloan's crayfish upstream of the northern drainage ditch (St. John 1993, 1996, and 1999).

St. John reported in the Addendum to the Report on the Status of the Sloan's Crayfish (St. John 1994) that Sloan's crayfish repopulation within Paddys Run is governed by downstream migration rather than upstream migration or repopulation in situ.

The preservation of the upstream portion of Paddys Run is also the primary protection effort for the Indiana brown bat (*Myotis sodalis*), a federally listed endangered species for which suitable habitat exists within the riparian areas north of the train trestle. This area will be considered a priority natural resource area, and a maximum effort will be made to preserve the stream and its associated habitat in its present state.

D.2.3 Restoration Commitment

Once remediation activities have been completed within the area of influence for Paddys Run, the stream will be restored to suitable Sloan's crayfish habitat, if necessary (Figure D.1-3). This stream restoration will take place in accordance with the sitewide Natural Resource Restoration Plan, as agreed to by the FEMP Natural Resource Trustees. It is expected the upstream refuge will act as the catalyst for the repopulation of impacted sections of Paddys Run, where pools and riffles will be reestablished.

D.3 FIELD MONITORING

Field monitoring will be conducted to determine the effectiveness of the sedimentation controls discussed above. Sedimentation controls will be inspected at least weekly in accordance with the FEMP SWPPP. Based on visual observations of sediment loading into Paddys Run in 1996 and 1997, DOE determined that the current SWPPP sedimentation control program adequately protected the Sloan's crayfish. The EPA and OEPA have agreed with DOE to cease visual observations of sediment loading to Paddys Run until either: 1) significant soil disturbances occur in the drainage area discharging to Paddys Run via the north drainage ditch; or 2) storm water control inspections indicate that sediment controls are not properly functioning. Pursuant to these criteria, visual observations have resumed as a result of construction activities in the vicinity of the waste storage area.

The Sloan's crayfish population of Paddys Run will be surveyed every three years in order to monitor trends in the long-term status of the population. This information will not be used as an indicator of remediation impacts, but rather as assistance in restoration planning.

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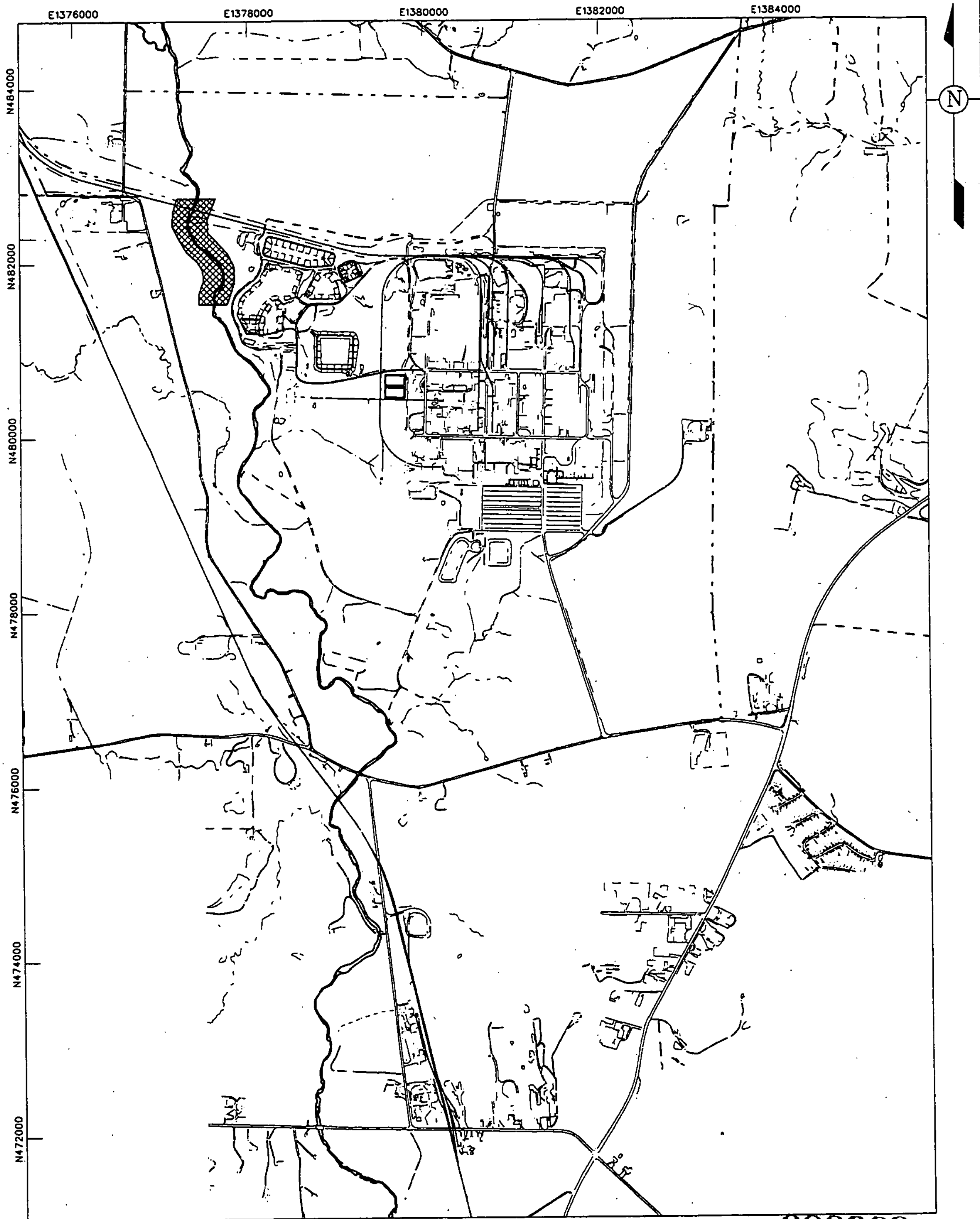

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LEGEND:

FEMP BOUNDARY

AREA OF INFLUENCE FOR PADDYS RUN

SCALE

1500 750 0 1500 FEET

FIGURE D.1-3. AREA OF INFLUENCE FOR PADDYS RUN

D.4 CONTINGENCY PLAN

This contingency plan includes provisions for relocating individual Sloan's crayfish. Relocation will be dependant upon field observations of Paddys Run as discussed above. These relocation provisions include the establishment of locations within Paddys Run, along with the frequency and methodology for relocation.

Relocation is an unproven technique that may result in harm to individuals. Problems associated with relocation include alteration of stream habitat from netting and species removal activity and loss of individuals from the stress of relocation. In addition, an otherwise healthy community could be impacted by the introduction of relocated species.

D.4.1 Relocation

The crayfish will be relocated further upstream within Paddys Run. Optimal habitat for the crayfish is a stream with constant current flowing over a rocky bottom, which occurs upstream of the train trestle in Paddys Run and within the refuge area illustrated in Figure D.1-2.

D.4.2 Frequency

Crayfish will be relocated as appropriate, up to a frequency of every two months, depending on stream conditions. If visual observations of the Paddys Run tributary indicate increased turbidity into Paddys Run for several consecutive days, then the crayfish will be relocated. If turbid tributary conditions persist two months after the initial relocation, then the crayfish will be relocated again.

D.4.3 Methods

Crayfish will be obtained by seining Paddys Run with a minnow seine (1.2 x 1.8 meters; 0.64 centimeter mesh). Pools and riffles will be seined several times in an effort to capture as many individuals as possible. Upon capture, crayfish will be placed in a plastic container containing existing stream water and transported upstream for free release. The location selected for release will be pre-determined based on the suitability of habitat.

D.5 REPORTING

Sloan's crayfish monitoring activities will be reported through Integrated Environmental Monitoring Plan annual integrated site environmental reports which will provide an update on Sloan's crayfish population surveys and contingency actions.

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REFERENCES

St. John, F.L., 1999, Fernald Site Crayfish Survey at Paddys Run, June 9, 1999.

St. John, F.L., 1996, Fernald Site Crayfish Survey at Paddys Run, September 18, 1996.

St. John, F.L., 1994, Addendum to the Report on the Status of the Sloan's Crayfish, *Orconectes sloanii* (Bundy, 1876) at the Fernald Environmental Management Project.

St. John, F. L., 1993, Report on the Sloan's Crayfish (*Orconectes sloanii* Bundy) at the Fernald Environmental Management Project.